ELECTRICAL REVIEW

15th MAY, 1953

Managing Editor: HUGH S. POCOCK, M.I.E.E. *Technical Editor:* W. O. FENWICK, M.I.E.E.
Industrial Editor: J. H. COSENS *Technical Consultant:* C. O. BRETTELLE, M.I.E.E.

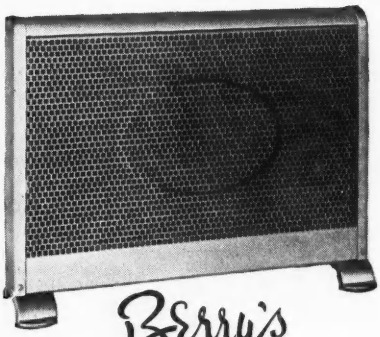
IN THIS ISSUE

Installation Incentives	1093
Making Motor-Car Bodies	1095
Ancient and Modern in North Africa	1102
The Economics of Metering	1105
Blondel Test	1107
Views on the News	1109
Personal and Social	1110
I.E.E. Report	1114
E.T.U. Conference	1115
Lighting Set Development	1117
Generator Excitation	1119
Correspondence	1121
Commerce and Industry	1123
Transmission Lines and Towers	1127
Electricity Supply	1129
Research in Rural Electrification	1130
Sales and Service	1133
Recent Introductions	1137
Financial Section	1138
New Books	1142
New Patents	1143
Next Week's Events	1144
Contract Information	1145
Classified Advertisements	135
Index to Advertisers	152

VOL. CLII: No. 20
Fridays: Price 1/-

EDITORIAL, ADVERTISING & PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home and Overseas £3 6s 0d: U.S.A. and Canada $11.00. Cheques & P.O.s (or Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD., and crossed "Lloyds Bank."

A NEW development . . .



Berry's

Raydair Heater

REGD. DESIGNS PATS. PENDING

in electric heating

The RAYDAIR Heater is a low temperature radiator with no wasteful rearward radiation.

Element specially constructed to radiate maximum amount of heat forward. Air intake at base of unit provides free-draught convection to carry heat from back surface upwards through front louvres.

Equipped with thermostat and pilot light. Finished in Peach Bronze, Penny Bronze and Warm Silver. Advanced design permits these competitive prices:— **1 kW £9 15s. 0d. 1½ kW £13 17s. 6d. 2 kW £20 5s. 0d.**

BERRY'S ELECTRIC LIMITED · TOUCHBUTTON HOUSE · NEWMAN STREET · LONDON, W.1

CAMBRIDGE *flik* GALVANOMETER

BRITISH INSTRUMENT INDUSTRIES EXHIBITION

OLYMPIA·LONDON JUN.30-JUL.11'53

STAND No. 7-B

This galvanometer has an exceptionally quick period—one tenth of a second with the high sensitivity given in the Table. Instruments with periods down to about 0.02 second can be supplied at a slight sacrifice of sensitivity.

Details are given in **SHEET No. 288-X**

May we send a copy ?

Coil Res. (ohms)	Period (secs.)	Sensitivity mm./μA at 1 metre	Ext. Res. for Critical Damping (ohms)
300	0·1	100	4000
20	0·1	20	100

CAMBRIDGE INSTRUMENT COMPANY LTD

13, GROSVENOR PLACE, LONDON, S.W.1

WORKS: LONDON and CAMBRIDGE

ELECTRICAL REVIEW

15th MAY, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLII • NO. 20

Installation Incentives

SINCE early last year a sub-committee of the National Joint Industrial Council for the Electrical Contracting Industry has had under consideration (among other matters) ways of increasing productivity. The contention of the employers that the present level is only 70 per cent of the pre-1939 " output," and in the case of casually recruited operatives only 40 per cent, was disputed by the union representatives who with some justification pointed out that identical work must be taken for the purpose of comparison, whereas the employers based their assumption on the larger labour content of present estimates for contracting work. There was tacit agreement, however, that increased production is desirable and that some inducement is necessary in order to attain it.

The difficulty—which has not yet been resolved—is to discover some practicable way in which individual " output " can be recognized while ensuring that workmanship is not adversely affected. Clearly, with electrical installation work, on which lives may depend, safety must come first. For this reason a system of payment by results suffers from an obvious defect. Provision already exists under the working rules for payments in excess of the standard rate to particular employees selected on the ground of special ability and responsibility or long service. This at present has only a limited application and consideration has been given to the possibility of extension. A suggestion made by the employers is that varying degrees of skill might be recognized by introducing a system of grading, with new designations to overcome objections to the use of numerical grades. This does not appear to have been acceptable to the sub-committee and in any case the union representatives were not favourably inclined to any kind of grading as visualized in the " Manchester " scheme which provided for a class of labourer under that of " mate," or to any form of zoning. They felt that more regard should be paid to the technical side of the industry, contending that comparatively little mechanization had been introduced. Compulsory registration

of contractors and operatives was also considered to be closely related to the improvement of standards of work. There the matter rests. Costly installations are a brake on the development of the industry; the temptation to keep the wiring of houses to the minimum, for example, means that the use of electrical equipment in the home will probably be restrained for many years to come. It is therefore in the interests of both employers and employees to seek maximum productivity and eschew restrictive practices.

STUDENTS' SECTIONS

Some disappointment with the results of extending facilities of Students' Sections throughout the country is expressed in the Report of the I.E.E. Council for 1952–53, which was presented at the annual general meeting yesterday. Although some papers read at technical meetings may be on subjects other than those that a student proposes to take up later, they probably broaden his professional background and thus mitigate the ill-effects of too early specialization. Social contacts between students at functions are also likely to be of lifelong importance. The foreword to the April issue of the I.E.E. *Journal* can be commended to the consideration of entrants to the profession as well as to senior members to whom it is primarily directed.

ENGINEERING APPOINTMENTS

The institution of an engagement fee, charged to the employer, whenever an appointment results from a nomination by the Professional Engineers' Appointments Bureau is an innovation which seems to the Bureau more preferable than its dependence hitherto on voluntary donations and periodic appeals to industry. The Bureau has not escaped the general experience of rising costs and difficult working circumstances over the last two or three years, but in spite of this its operation has been satisfactory. There still remains, as indicated on another page and for reasons over which the Bureau can have little control, a rather large discrepancy between the total offers made and the number of acceptances.

B.E.P.C. PUBLICITY

This year's British Electrical Power Convention is being held just after Coronation week and on this account will have to compete with matters of greater public interest for attention in the national Press. With this in mind the Convention Council last week called a meeting of representatives of the national and non-electrical trade newspapers in an endeavour to secure some advance publicity or, at any rate, to ensure that the Convention was properly noted in the newspapers' calendar of events to be covered. It was perhaps too optimistic to expect the Press to say much about the Convention a month before the date, but it is to be hoped that the second aim has been achieved and the national importance of the Convention will receive due recognition while it is in progress.

WAGES AND HOURS

Not only has the Amalgamated Engineering Union voted in favour of demanding a 15 per cent increase in basic wages, it has also decided to pursue a claim for the reduction of the working week from 44 to 40 hours without reduction of pay. This, in effect, is a demand for further wages because the "lost" four hours would still have to be worked as overtime. The claims are based largely on the engineering industries' increased profits and the rise in the cost of living. It seems hardly likely that profits will continue to increase and the living costs will be further inflated by this and other claims for higher wages. The A.E.U. president, Mr. J. Tanner, said that the members must feel that their claim was realistic but in view of the present trend of export trade it can hardly be so described.

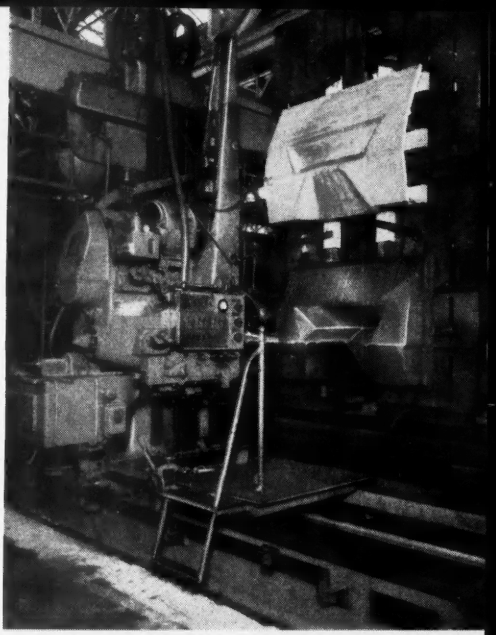
Making Motor-Car Bodies

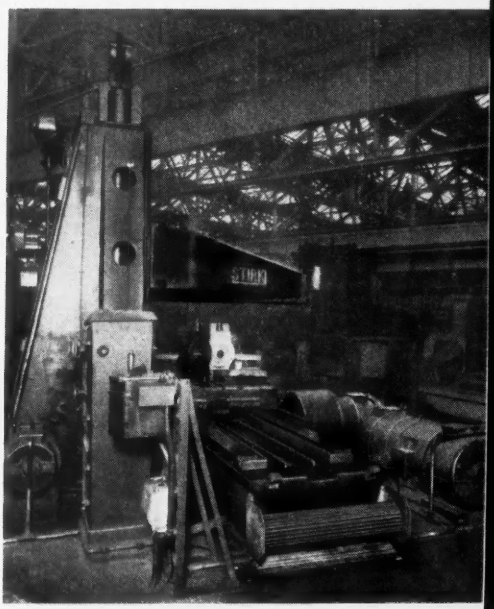
Mechanization and Welding at a Birmingham Factory

FEW people realize how much the motor-car industry depends on the body manufacturer. Probably it is generally thought that the maker of car bodies produces an assembly of pressings forming one of a large number of components for the manufacturer who makes the engine and by whose name the car is known. Actually, in many cases, the reverse is nearer the truth for when a car body leaves its makers it is in effect a complete car except for the addition of the engine and the wheels. It is supplied completely wired and is fully finished with upholstery and final cellulose spray.

In the large scale and high speed production methods adopted in the modern car body works manufacture is completely dependent on the use of electricity at practically every stage. Apart from the general mechanization of production processes there is a complete mechanical handling system as well as a very widespread use of electric welding and, it almost goes without saying, the most up-to-date illumination. An idea of the scale of use of electrical methods can be gained from the fact that at the motor-body factory of Fisher & Ludlow, Ltd., in Kingsbury Road, Birmingham, the maximum demand reaches about 9,000 kVA and the consumption about 27 million kWh a year. There are about 12,000 h.p. of motors installed (a large proportion of which, for standardization purposes, are of E.C.C. construction) and connected loads of 40,000 kVA for welding and 2,000 kW for lighting.

Production may be said to start in the department where the wooden patterns are made from which the various metal dies for the presses are produced. The electrical





Keller profiling machine for producing the steel dies required for the presses and (below) Stirk split-drive heavy-duty planer for finishing the steel dies ready for the presses

equipment here includes circular and band saws, planers and sanders, mostly Wadkins and all individually driven. A dust extraction plant is provided.

In the die making section the shapes produced on the wooden patterns are transferred to the steel dies by means of eight Keller electrical tracing machines which are capable of cutting in two directions. Each incorporates seven motors covering the horizontal (1½ h.p.), vertical (1½ h.p.) and transverse motions (1½ h.p.), two magnetic clutches to each drive, the cutting motor (7½ h.p.), the oil circulating pump (½ h.p.) and a screw conveyor for removing swarf. Speed control (from 600 to 2,400 r.p.m.) is provided for all directions of travel, the tracing motions being regulated by a series of relays operated from a 15 V d.c. supply.

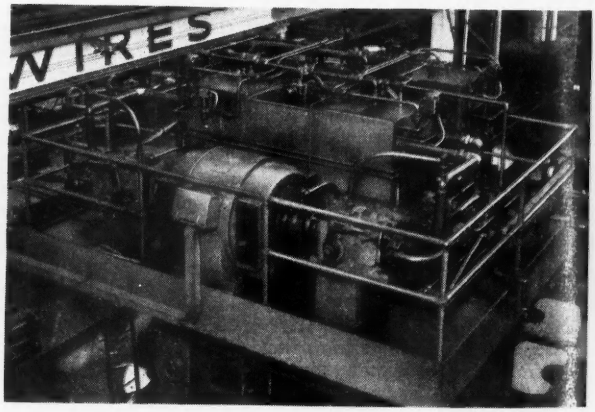
A pilot station at the top of each machine, which is about 12ft high, besides including all the necessary controls, is equipped with an ammeter to give an indication of the load on the cutter. Overload protection is provided on all the motors. These Keller machines all operate on 115 V d.c. Six are run from a 250 A glass bulb rectifier (Electric Construction Co.), which has given such good service that a motor generator set kept as a stand-by has never yet had to be used. The supply for the other two machines is provided by Crompton Parkinson 16 h.p. motor generator sets.

Apart from large numbers of radial drills, slotters and bedding presses for grinding off the roughness left on the dies after the initial operation in the Keller machines, there are four large Stirk planing machines which are specially designed for high-speed work with d.c. injection braking and quick travel of the carriage back between cuts and over gaps.

Employing a split field drive, each machine incorporates a motor generator set with a 40 h.p. motor running at 1,460 r.p.m. and driving a double commutator machine which by altering the field circuit gives 26 A or 140 A at 230 V d.c. for controlling the table motor and providing d.c. for all other actions. Three tool boxes are provided, solenoids being arranged to lift the tools during the return stroke and move them a distance governed by gears and a motor with a half and full turn feature. The machine is equipped with an Erskine Heap starter and a Brookhirst control panel. A hardening shop for tools used in this department is equipped with a Birlec furnace.

The largest of a number of Lumsden grinders used for further treatment of the dies is driven by a Metrovick 100 h.p. motor with ½ h.p. and 8 h.p. motors for the feed and the table rotation and suds pump. A magnetic table is incorporated, the d.c. being provided by a Heayberd rectifier, and there is a rotary magnetic separator (Gaston E. Marbaix) for suds cleansing. The unit is controlled by a panel supplied by Contactor Switchgear, Ltd., which was also responsible for the multi-motor controls for a number of horizontal and vertical borers, lathes, vertical millers of different sizes and precision grinders. Other tools, all individually electrically operated, include saws, shapers and slotters.

A cyclone dust extraction plant serves the whole of this department but as a special precaution the Société Génévoise high precision drilling machine is installed in a separate air-conditioned room. High-speed grinders which operate on 200 c/s 125 V



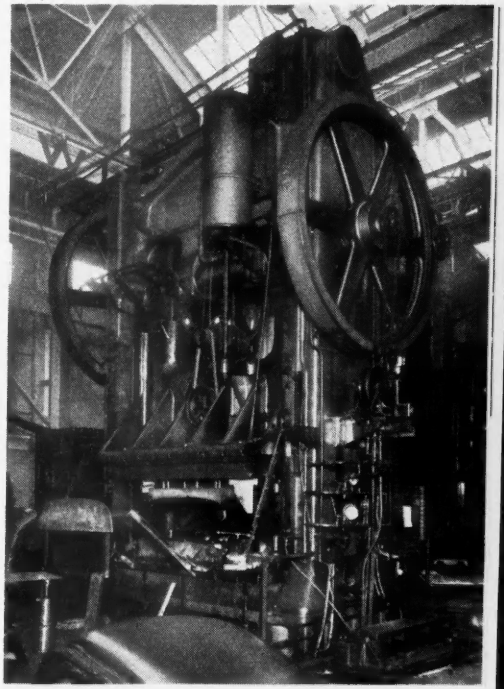
One of the most powerful presses used is this hydraulic unit for making deep draw pressings; it incorporates two pumps driven by an E.C.C. 200 h.p. motor

three-phase current are employed for die grinding.

In the press shop there are hundreds of presses used for stamping out the various chassis members, bonnets, side panels, doors, etc. These are arranged with the heavy units on one side of the shop and the light presses on the other. One of the most powerful is a British Clearing hydraulic press used for making deep draw pressings. The two pumps of this unit are driven by an E.C.C. 200 h.p. double spindle motor with a Contactor Switchgear control panel, electrically operated hydraulic valves controlling the operation of the ram.

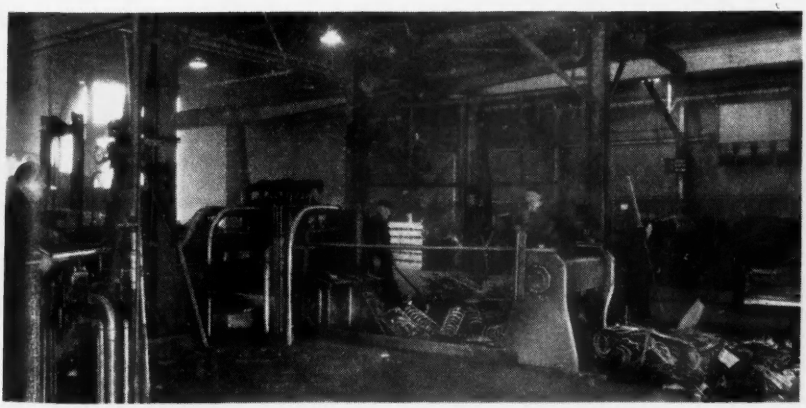
Special narrow presses operated by 60 h.p. motors are used for making chassis members. Portable high-frequency tools are available for minor adjustment of the dies after they have been fitted in the presses. There are in fact four 20 kVA L.D.C. and B.T.H. frequency changers provided for these tools in each of the five factory blocks.

To remove stresses from the sheet metal before it goes to the presses a normalizing machine has been provided with an E.C.C. two-speed 35/16 h.p. motor with Ellison control, the speed employed depending on the thickness of the metal being treated. The guillotines used for cutting the metal ready for the presses are driven by motors ranging from 5 to 20 h.p. according to the size and thickness of the sheets. An overhead conveyor system carries the components from the presses to the stores or to the assembly shop as required. The press shop, as well as other departments, has

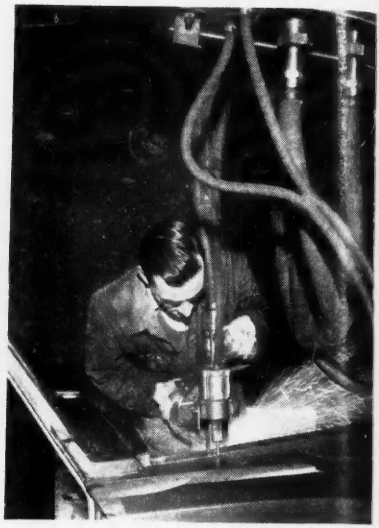


Bliss drawing press

Waste scrap metal from the press shops is fed into a hydraulic bundler



Many of the chassis parts, etc., are welded with the aid of multi-operator arc welding sets



Pincer type portable spot welders are employed for such operations as welding the bonnets

large electrically operated doors with G.E.C. equipment.

Waste metal from the press shops is taken to a separate building where with the aid of a G.E.C. magnet it is fed into a hydraulic bundler operated by an E.C.C. 75 h.p. motor with Contactor Switchgear control panel. A 5 ton overhead crane (S. H. Heywood & Co.) is employed for lifting and tipping trucks, etc.

As already mentioned, there is a connected welding load of 40,000 kVA, representing altogether about 600 welding machines employed throughout the factory for sub-assembly and assembly purposes. In the main body assembly department, where bodies for the Standard "Vanguard," the Standard "8," the Triumph "Mayflower," and the Nash cars are made, there are 130 portable welding machines as well as several fixed units.

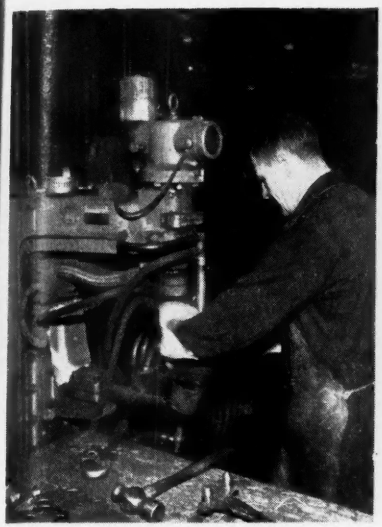
Sciaky 70 kVA pincer type portable spot welders are employed for such sub-assembly operations as welding the bonnets (in this case two operators work from one machine), clinching of inner and outer panels of doors and fronts, sub-assembly of turret top, left and right hand sides of the body, bonnet and doors, and the building up of the floors and sides on jigs.

Many of the chassis parts, etc., are welded with the aid of English Electric multi-operator (6–16) arc sets. Projection welding is employed for making such parts as the smaller brake shoes from flat metal, a hydraulic pressure feed rolling the metal as it receives its 6 to 10 spots: since the G.E.C. thyratron welding control used is very responsive to voltage variations Foster voltage regulators are employed. The larger brake shoes are made two at a time by Fusarc automatic arc welding sets.

The two halves of the wings are seam welded by Sciaky machines. The completed body and chassis sub-assemblies are placed on stillages for welding together from underneath. Transferred to rails, the units, after receiving their window-frames, are placed on a conveyor where they have their door hinges, bonnets, etc., fitted ready for the first metal protection treatment.

In the Carrier "Rotodip" continuous tunnel plant, the bodies, suspended from a "spit" passing lengthwise through them, are washed, rinsed in water and chromic acid, dried and "bonderized" and receive an undercoat of cellulose paint. Electrically operated pumps circulate the various solutions through the tanks.

The bodies are turned over and over the



Spot welding chassis brackets

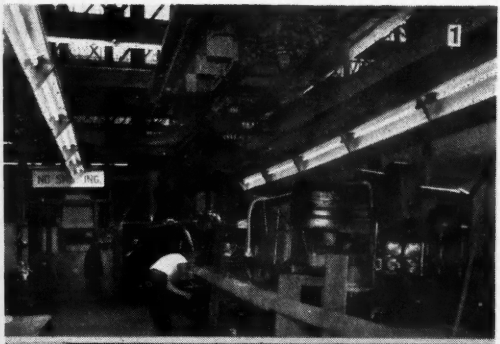
Seam welding a wheel arch

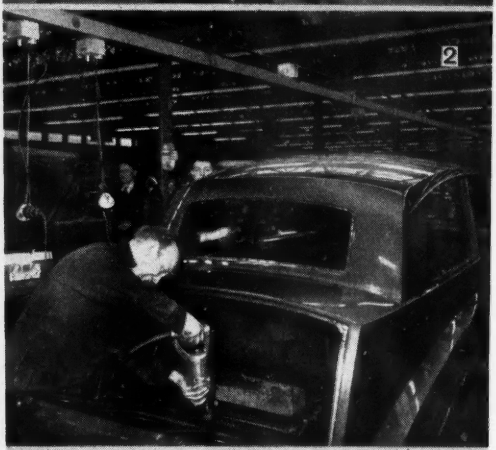
whole time they are travelling through the tunnel and any stoppage immediately operates a limit switch or breaks a shear-pin, so stopping the whole machine and showing on an illuminated panel where the trouble is. Indicators also show which motors are on circuit and so ensure the correct sequence of operations when starting up the plant. Most of the 36 motors in this plant are of E.C.C. make and are equipped with Donovan starters. Fire protection is provided in vital areas by thermostats and " Pyrene " equipment, which, when operated, releases the main Switchgear & Cowans breaker, operates an alarm in the fire station, jettisons the paint into a tank, and releases fire extinguishing gases over the entire vulnerable area. Flame failure in the oil-fired drying section of the plant is revealed instantly by means of " Protectoglow " panels used in conjunction with photocells which are directed on to the burners.

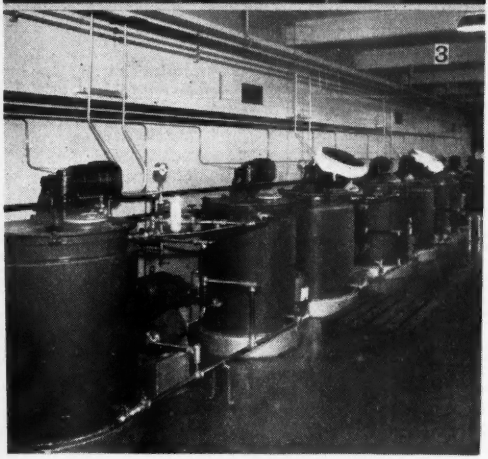
Leaving the " Rotodip " plant, the bodies are inspected before being passed on for fitting out, wiring and upholstering. In most of the factory the illumination is by 400 W high pressure mercury lamps, but here and in subsequent inspection departments fluorescent lighting is installed, mostly employing " Thorlux " twin-tube units manufactured by F. W. Thorpe, Ltd., and generally incorporating 5ft 80 W tubes. The biggest fluorescent lighting load is in the block which comprises the trim shop, the components assembly and the metal stores. Here can be seen an impressive installation comprising 19 rows of 33 twin-tube units, with " Thorlux " detachable vitreous enamelled reflectors, giving a lighting intensity of 22 lm/sq ft on the working plane.

In the trim shop, where the upholstering, wiring, etc., is done, the electrical equipment includes a conveyor system, high frequency drills and a large number of Singer sewing machines, these being connected by means of Donovan switched plugs and sockets. Another Donovan device, the " Runtact " overhead busbar runway system, enables portable drills to follow the bodies along the conveyors.

" Thorlux " single 80 W vitreous enamelled angle reflectors in the flatting section of the final cellulosing department enable blemishes in the finish to be readily detected, while in the spray booth the fluorescent tubes have been installed behind glass panels. The electrical arrangements for the drying tunnel follow much







the same lines as those for the "Rotodip" installation already described, a system of visible and audible signals being employed to give warnings of any stoppage or failure. A silhouette switch helps to ensure that the bodies do not get jammed in the tunnel. In the paint room, in which the mixers and pumps are driven by Crompton Parkinson 1½ h.p. motors, the whole installation has been carried out in Pyrotenax mineral insulated cable.

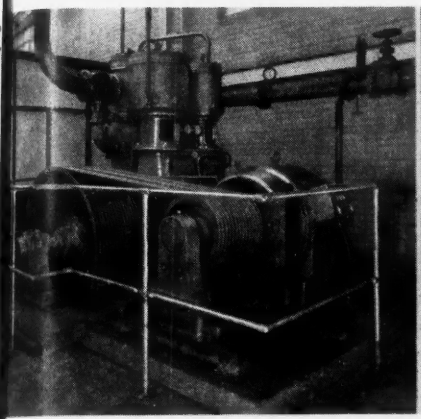
Compressed air required for the paint spraying, etc., in this block is provided by two Belliss & Morcom units driven by E.C.C. 100 h.p. motors. Six further Belliss & Morcom compressors (four driven by 155 h.p. and two by 113 h.p. motors, all Crompton Parkinson) serve the press shop.

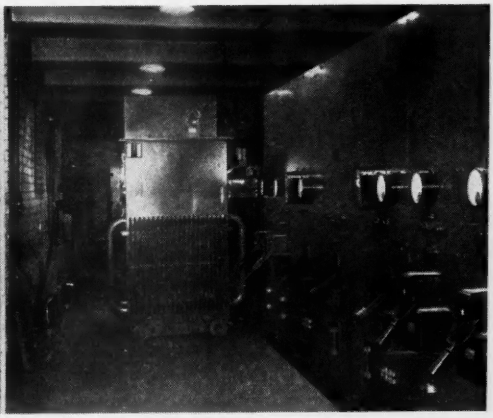
Further electrical equipment not at present used on car body manufacture (the company makes numerous other items apart from car bodies) includes "Argon-arc" welders and 660 kW of infra-red drying plant (G.E.C.). In addition to this production equipment the factory is well electrified in other directions. Apart from the various facilities provided in the offices, the canteen is equipped with G.E.C. ovens and fish fryers; Hobart mincers, potato peelers and dish washing machines; Euk bread slicers; Crypto potato chippers; a Concentric Manufacturing Co.'s pie-making machine; an Eldwood ice-cream cabinet; Marco refrigerators; and a Frigidaire cold room.

The 11 kV feeders are brought into the factory to feed the five blocks which altogether are provided with thirteen substations: two each in the three blocks comprising the painting and trimming departments, the body assembly and the tool room; three in another assembly block at present employed only partly on car bodies; and four in the press shop. Typical equipment of a substation comprises two 750 kVA, 11 kV/400 V transformers (B.E.T. or E.C.C.), one supplying power only and the other power and lighting. An E.C.C. induction regulator ensures a stable voltage.

The h.v. switchgear was supplied by the General Electric Co., Ltd., and the l.v. gear

(1) Fluorescent lighting is used for the body finish paint inspection. (2) The "Runtact" system enables portable tools to follow bodies along the conveyors. (3) Pyrotenax mineral insulated cable has been employed throughout the paint mixing department





Left: **Compressor driven by a 225 h.p. E.C.C. slip-ring motor.** *Right:* **E.C.C. induction regulator and Metrovick l.v. switchgear in one of the substations**

by the Metropolitan-Vickers Electrical Co., Ltd. In the substation of the brake shoe welding plant a 1,000 kVA 11 kV/400 V "Metrovick" transformer has been provided with a Switchgear & Cowans 250 MVA main switch and six 800 A circuit breakers. Facilities are provided by means of bus-couplers to transfer load from one substation to another. On each side of each block are three English Electric 300 A switch panels each supplying six sets of overhead busbars to which the various machines are connected. A Crossley 90 h.p. diesel engine driving a Crompton Parkinson 65 kW generator provides a 230V emergency lighting supply for the whole factory.

We are indebted to Mr. H. W. Harper, M.B.E., director and general manager, Fisher & Ludlow, Ltd., for permission to prepare and publish this article, and to Mr. T. Tonks, B.E.M., chief electrical engineer, for his guidance and for the provision of necessary technical data. The photographs were provided by the Electric Construction Co., Ltd.

STREET LIGHTING NOTES

THE borough surveyor and lighting superintendent of HASLINGDEN are to prepare a scheme for improved lighting from Lockgate to Baxenden.

DARLINGTON Streets Committee has approved a £4,550 scheme for improving the electric lighting of North Road.

Conversion of street lighting from gas to electricity is being considered by the LONG BUCKBY, Northants, Parish Council.

TAVISTOCK'S new £5,000 street lighting scheme, which was switched on recently by the U.D.C. chairman, is one of the largest installations of its kind in Devon. Ninety-six 140 W sodium vapour lamps cover the Okehampton, Plymouth and Callington approaches to the town and the whole of the shopping centre.

ROYSTON U.D.C. is seeking the approval of the Ministry of Transport to a scheme for the lighting of Melbourn Street and the Town Hall roundabout.

BRADFORD Finance and General Purposes Committee has approved a scheme submitted by the street lighting superintendent for street lighting by electricity on the Thorpe Edge housing estate at an estimated cost of £6,093.

HEYWOOD Corporation is recommended to seek sanction to borrow £1,570 for the provision of street lighting on housing estates.

MAIDSTONE Works, Plans and Town Planning Committee reports that the Ministry of Transport has now sanctioned a scheme for improved lighting in Sandling Road between Monckton's Lane and Sessions House Square at a total estimated cost of £2,510.

Ancient and Modern in North Africa

By DIANA ANLEY

A 10,500 kVA Water Power Project

FROM a small water wheel of the Kabylie tribe to a modern hydro-electric power station is a step which shows the advancement of civilization in the French North African colony of Algeria.

The Acif-el-Hamman scheme, situated in the mountainous Kabylie country of Eastern Algeria, forms an important part of a large hydro-electric programme that is being put into operation by the Electricité et Gaz d'Algérie.

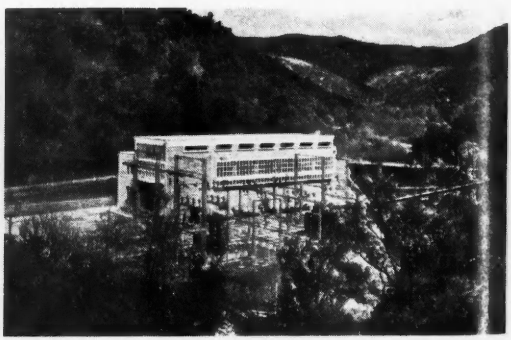
The river rises in the Djurdjuras and is fed by torrents rushing down the northern slopes of those mountains. Constancy of flow is assured by springs gushing out in the river bed. They are the outlets of a large subterranean reservoir, formed by calcareous fissures of rock. The natural catchment area, some parts of which are at an altitude of over 2,000 metres, measures about 25 sq km.

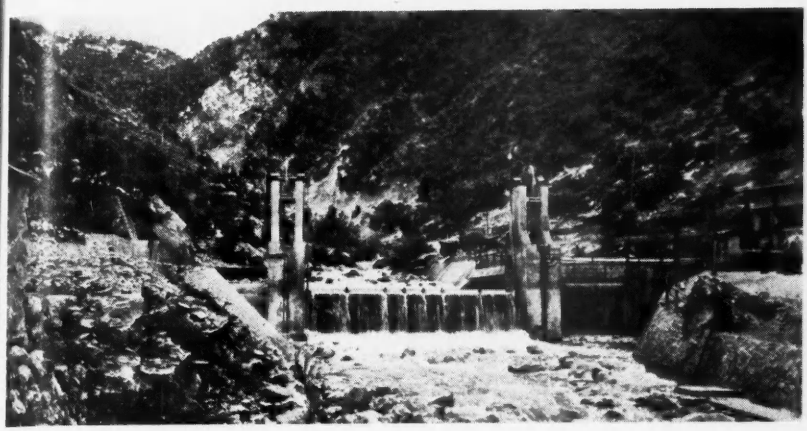
By means of the power station of Souk-el-Djemaâ—or, to give its French name, of Michelet—an annual output of the order of 22 million kWh is expected to be made available, which should be sufficient for the needs of the entire Grande Kabylie, with a reserve to be distributed to large consumption centres throughout Algeria.

A dam has been constructed across the river at an altitude of 762 metres. It has a centre opening eleven metres wide down to the bed of the river, sealed by a mobile gate for automatically regulating the water level at the intake to maintain a constant level, whatever the flow of the river upstream. In the event of abnormal flooding, which frequently occurs at these high altitudes, the sluice-gate automatically lowers itself, leaving the bed of the river clear. It can also be operated from a distance by means of oil pressure servo-motors housed in a special building. The water passes through special racks to free it from gravel and sand before entering the head-race tunnel.

The steep incline of the gorge in which the power station is built has made it necessary to take precautions against accidental overflow downstream. As well as protection gear at the head of the pressure pipe, the maximum flow has been

A small water wheel of the Kabylie tribe and (right) the power station of Souk-el-Djemaâ (Michelet) hydro-electric scheme





Intake from river to pressure pipe line

limited at the tunnel entrance, irrespective of the height of water in the intake.

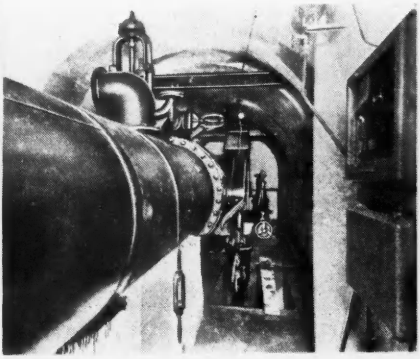
The head-race tunnel is the most important part of the fall of Michelet. It is about 5,100 metres long with an inside diameter of 2 metres. To increase resistance and render it watertight, the outer wall has been reinforced with concrete of varying degrees of thickness, according to the nature and consistency of the ground traversed.

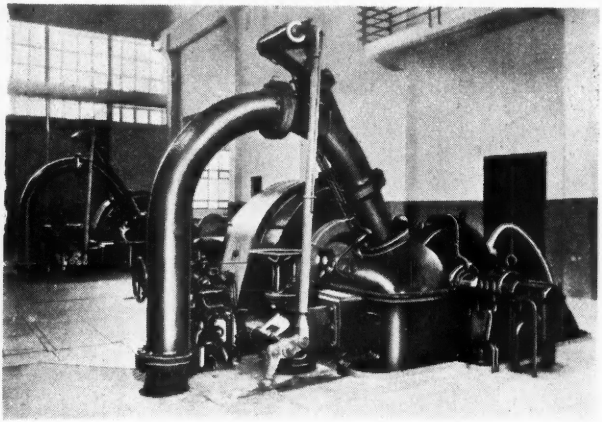
To harmonize production of energy (which is essentially linked to river flow) with electrical needs, water storage must be provided upstream from the fall. The geographical disposition of the valley in which the Acif-el-Hamman flows did not permit of the construction of a large reservoir.

It was consequently decided to utilize the tunnel itself as an " accumulator " by providing alternatively for it to function under full charge or free flow. This arrangement allows for the constitution of a reserve equivalent to about 10,000 kWh over and above the normal flow.

Owing to the instability of the surface ground at the downstream end of the tunnel the surge tank, or expansion chamber, has been placed underground.

A view of the pressure pipe and (right) protection apparatus at the head of the pipe





The machine room, showing two of the turbo-alternator sets

The pressure pipe is composed of lengths of steel plate assembled and electrically welded on site. It is 920 metres long, of a variable diameter of about one metre and provided with a stop-valve and automatic security device, which can also be controlled from the power station.

Souk-el-Djemaâ, with its 60 kV switchyard, built on the right bank of the Oued Djemaâ at a distance of one km from its confluence with the Acif-el-Hamman, occupies a confined space at the bend of the river. The hydro-electric equipment consists of three 3,500 kVA turbo-alternators. The turbines, installed by the Societé Alsthom Charmilles, are of the two-jet horizontal shaft Pelton type with a speed of 750 r.p.m., directly coupled to three-phase, 50 c/s, 5,750 V alternators. The control room is on the first floor adjoining and overlooking the machine room. A special chamber has been set aside for apparatus necessary for telecommunication by high-frequency carrier currents.

At the outdoor substation the voltage is stepped up to 30 kV and 60 kV by air cooled 7,000 kVA transformers.

As the power station is situated at the extremity of the 30 kV distribution lines of the Grande Kabylie, it can operate in parallel with the two thermal stations at Algiers. Surplus energy is fed to the 150 kV grid through the intermediary of the 60/150 kV substation at Dra-el-Mizan.

Many difficulties were encountered during the construction of the Acif-el-Hamman scheme. It was started at the beginning of 1940, during the war, when the shortage of materials made the civil engineering work very difficult. Operations were spread out over a distance of 10 km of mountainous country. The nearest railway was fifty miles away at Tizi-Ouzou and means of transport over difficult terrain was a problem owing to the acute shortage of liquid fuel. The insufficiency of every kind of material both in quantity and quality added to all these trials and slowed down work considerably.

On top of these general problems came a geological accident in the subterranean tunnel. The ground consisted of micaschists which were not difficult to penetrate, but work suffered a severe setback in the first thousand metres near the intake. A thermal spring with a pressure of 70 lb/sq in was encountered in a zone of heterogeneous rubble. This called for consolidation by the injection of about 400 tons of cement under pressure in order to provide a deviation to by-pass the danger zone.

In spite of all these difficulties, however, Souk-el-Djemaâ (Michelet) was successfully completed.

Belgian Electrical Trade

BELGIAN exports of electrical goods last year increased in value by about ten per cent on 1951 and imports of such materials by nearly twenty per cent. The totals were: exports 3,680 million francs and imports 3,204 million. Principal customers were: Holland, Belgian Congo (with an increase of 80 per cent), United Kingdom, Brazil, U.S.S.R. (with a tenfold increase) and France. Belgium's chief suppliers of electrical manufactures were the United Kingdom, Holland, West Germany, United States, Switzerland and France. The U.S.S.R. also sent a small quantity.

The Economics of Metering

Consumers' Load Characteristics

FOR some time meter engineers have felt the need for a rigorous examination of the economics of metering which concerns both the design of meters and their use. This is done in a paper prepared by Messrs. L. B. S. Golds (Eastern Electricity Board) and P. Schiller (B.E.A.) which was presented at a recent Measurements Section meeting of the Institution of Electrical Engineers.

After setting out some of the problems of metering, it is emphasized that wherever possible the approach should be on the basis of economics. Since no rational solutions can be found without adequate information about consumers' load characteristics, including the spread of the actual consumption over the load range of meters, a pilot investigation on operational-research lines has been arranged.

Under the ægis of the Utilization Research Committee of the British Electricity Authority and Area Boards, a sample of 110 domestic consumers was drawn from a large urban area, and a novel load-analysing meter and a demand indicator were installed with each of them for a year concurrently. From the data obtained, supplemented by previous E.R.A. work, it is suggested that for installed loads of up to 40 A, a meter of nearest (but no lower) maximum continuous rating should be chosen, whereas for all higher loads encountered so far, a meter of 40 A m.c.r. would be sufficient.

With the meter sizes used in the area concerned, just under 13 per cent of the total consumption was found to have been taken while the individual consumers' loads did not exceed 10 per cent of the normal ratings of the meters, and only 8 per cent while these ratings were exceeded. Analysis by meter size showed the load sub-ranges in which the highest concentrations of consumption might be expected. From a composite picture of the distribution of consumption at various loads it emerges that as much as one-third of the total annual consumption was taken while the individual consumers' loads did not exceed 5 A, and well over a half while they were below 10 A, whereas less than a tenth was taken at loads exceeding 20 A.

DISCUSSION

Mr. O. Howarth (North Western Electricity Board), who opened the discussion, referred to the suggestion that a 20 A meter should be included and said that the problem had to be faced of the reliability of the information which was available when a decision was made upon the size of meter to be installed. That decision was not made by meter people but by district staff who must have some rough and ready formula on which to determine the rating to be used. The more ratings available, the greater the liability of error in determining the ratings to be installed.

Mr. S. Howarth (Ministry of Fuel and Power) pointed out that the assessment of the error of the actual registration was the crux of the problem, and was dependent on a number of variables. Statistical analysis might supply the answer. If a correct appraisal of the matter were to be made, a knowledge of the general behaviour of meters with years of service was essential and should be obtained continuously to take account of changing circuit conditions and improved designs of meters.

Mr. S. F. Musson (B.E.A.) said there were many advantages to the user and to the manufacturer in having one size of meter, and there were many existing small-size meters which could be used for supplies such as offices, shops, small works, etc. If only one size of meter were used the manufacturer could concentrate on getting the best performance on the one type, and the meter test-room staffs could carry out their work more efficiently. The authors did not stress sufficiently that stability was of equal if not greater importance than initial accuracy, although a good meter would have both.

Mr. M. Whitehead (Ferranti, Ltd.) suggested that a broader view should be taken.

It would seem that the supply authority was interested not so much in the accuracy of individual meters, as in the mean accuracy of groups, from a group of industrial consumers right down to the very large group of domestic consumers. On the other hand, the consumer was usually interested in only one meter, and since he paid for everything it was in his interest to have his metering at the highest economical level.

Mr. H. S. Petch (B.E.A.) thought that the trend in meter design would be towards that which would give adequate accuracy at loads which were above the maximum continuous rating. The export situation should be considered in that connection with a view to taking for home use the meters which manufacturers could sell overseas.

Mr. F. H. Dennis (S.W. Electricity Board) criticized the size of the samples given in the paper, but Mr. Schiller pointed out in reply that it proved so difficult to get sufficient consumers ready to co-operate and, where space permitted, the installation of the rather bulky test meter, that they were happy to be able to get a sample at all.

Sampling Tests

Mr. D. J. Bolton (B.E.A.) said it was obvious that there must be many more sampling tests of the type described from which it should be possible to make up a sort of composite or national load distribution and apply it, on paper, to a batch of meters of different makes. By some means of integration it would then be possible to work out the aggregate loss to the undertaking, and by doing this on a number of different servicing periods a scientific basis would be obtained for assessing the economic length of the service period.

Mr. S. A. Daines (Eastern Electricity Board) felt there was a danger of 10 A m.c.r. meters being used too frequently, and suggested that they should not be used where the installed load exceeded 3 kW, that is, 12·5 A at 240 V, always assuming there was no specified overload characteristic of meters which had to be taken into account.

Mr. A. H. Gray (Metrovick) referred to the legal aspect and said it was interesting to note that there was a possibility of the introduction of a time function. If and when that time function were introduced the technique should be based on an engineering rather than on an accountancy basis.

Mr. J. Prince (Ferranti) said he was always impressed by the emphasis given to the accuracy of electrical measuring, but to the consumer there was the second factor of the conversion figure, for converting units to money. The calculation of that conversion factor was a very complicated affair and could not always be achieved with theoretical accuracy. Comparisons of the inaccuracy between electrical measurement and the conversion factor should be shown and stipulated.

Mr. W. Bamford (Everett, Edgecumbe) also contributed to the discussion and dealt with the economics of metering.

Meter Testing

Approval of Amendments

ATTENTION is drawn by the Ministry of Fuel and Power to the letter it addressed some time ago to the Electricity Boards concerning proposed amendments to the requirements for the testing of electricity meters for certification, as approved by the former Electricity Commissioners in 1937. The amendments became necessary principally on account of the issue of B.S. 37 : 1952 and the introduction of maximum continuous rating meters and were as follows:—

Long duration dial tests (method A): The duration of the tests was to be reduced to the minimum period corresponding to five complete revolutions of the pointer of the last dial of the meter under test. Certain older meters fitted with cyclometer or roller dials may, however, need longer tests than the minimum of five revolutions of the last dial; in such cases the duration of the test was to be agreed with the area meter examiner.

Actual tests.—(*a*) Single-phase a.c. whole current meters: a choice of test loads was to be allowed thereby permitting greater flexibility and the grouping for testing purposes of the three categories of meter. It was, however, to be noted that for certification purposes meter examiners were required to be satisfied that meters were within the legal limits of error throughout the ranges specified in the appropriate B.S. 37. (*b*) Single-phase three-wire meter balance tests: the requirements in this case were to be amended to bring them into line with similar balance tests on polyphase meters.

The above-mentioned changes were approved by the Minister on 25th February, but further amendments are under consideration, so that a complete revision of the approval will be issued in due course.

BLONDEL TEST

Accurate Determination of Leakage Reactance

By T. F. WALL, D.Sc., D.Eng., M.I.E.E.

THE leakage reactance x_L ohms per phase of a three-phase generator is not only a dominant factor in the study of the performance of this machine (for example, it has a controlling effect on the short-circuit current) but it is also a factor of great technical interest. What follows is a brief account of the Blondel Test for obtaining an accurate measurement of the leakage factor x_L.

Suppose that the field excitation is i_f amperes and is set at the value defined by point Q in Figs. 1 and 3. If the generator is short circuited at all three terminals, the corresponding value of the short-circuit current per phase will be $I_{s.c.}$ amperes. Then, assuming that the copper losses are negligibly small, the armature reaction will be purely demagnetizing and will therefore, to a large extent, neutralize the field excitation ampere-turns. This demagnetizing effect can be expressed as $I_{s.c.} \times D$ ampere-turns where D, which may be termed the "demagnetizing factor," is a characteristic constant of the machine and independent of the armature current.

The effective field excitation will then be given by the field current Op as measured on the abscissa axis (Figs. 1 and 3). The e.m.f. which is induced in the generator per phase will then be given by the ordinate pP so that the following equation would then hold:

$$pP = E_L = I_{s.c.} \times x_L \text{ volts per phase} \ldots . (1)$$

That is to say, if the demagnetizing factor D were known, the product $I_{s.c.}D$ would also be known and the value of the leakage reactance could be at once found and the problem would be solved.

In what follows, however, a graphical construction will be explained by means of which the leakage reactance x_L can be measured without reference to the factor "D."

When the generator is excited and short circuited at all three terminals there will not be any voltage at its terminals and the short-circuit current of $I_{s.c.}$ amperes per phase will then flow in the windings of the generator stator. This current will be due to the effective field excitation Op while the induced e.m.f. is then E_L volts per phase and, since there will not be any voltage at the terminals, it follows that the induced e.m.f. is completely absorbed in driving the current $I_{s.c.}$ against the leakage-reactance of x_L ohms per phase, so that:

$$E_L = I_{s.c.} \times x_L \ldots \ldots . (2)$$

If then (Figs. 1 and 3) the line QP is drawn the triangle pPQ is obtained; this is known as the Potier Triangle and it has an important technical significance especially in connection with the performance of three-phase generators.

The Blondel Test is based on the characteristic features of the Potier Triangle and it will now be seen how the graphical construction may be derived by means of which the magnitude of the leakage reactance x_L may be found with a high degree of accuracy.

When the three-phase choke coil (Fig. 2) is connected to the terminals of the generator

Fig. 1

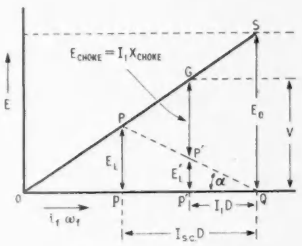
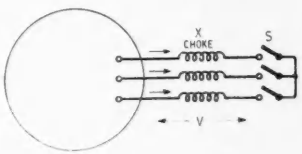


Fig. 2



and short circuited at the free end, current will flow in the circuit system so obtained and the e.m.f. developed by the choke coil will be directly opposed to the e.m.f. developed by the generator. The induced e.m.f. of the generator will drive the short-circuit current against the back e.m.f. of the choke coil.

When the choke coil is indefinitely large, no current will flow and the Potier Triangle will collapse into the point Q of Fig. 1. When the choke coil is indefinitely small, the full short-circuit current will flow and the Potier Triangle will attain its full value QpP as shown in Fig. 3.

Suppose now that the three-phase generator is excited to a condition of high saturation (Fig. 3) per phase, it will be assumed that the excitation is defined by the point R, that is 245 volts.

The following numerical data were obtained from a test made on a 10 kW three-phase generator. The open circuit characteristic was obtained for a range of values up to 245 volts as shown by the point R. The field excitation was 0·48 ampere and this value was kept constant throughout the test.

When the generator was short circuited at all three terminals, the short-circuit current per phase was 47·5 amperes, and when the choke coils were connected in series with the generator and short circuited the current was 13·7 amperes per phase. The voltage at the armature terminals was then found to be 200 per phase, that is, the voltage at the junction of the generator terminals and the choke coils.

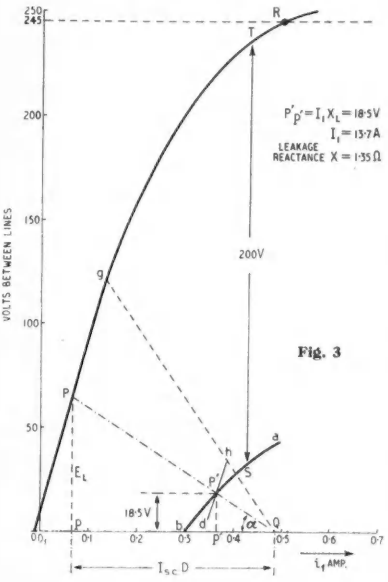


Fig. 3

The procedure was then as follows:

(i) A series of vertical parallel lines was drawn in Fig. 3 such as the line TS, the length of each of these parallel lines being equal to 200 volts. In this way, the graph aSb of Fig. 3 was obtained.

(ii) A series of rays was drawn from the point Q to the straight-line section of the O.C.C. graph as indicated by the line Qg. Each of these rays is then divided in the ratio of the two short-circuit currents as given in the preceding paragraph, viz.: $\frac{13{\cdot}7}{47{\cdot}5} = 0{\cdot}28$ and in this way the straight line hP'd of Fig. 3 was drawn. The two lines ab and hd cross at the point P' and therefore the required Potier Triangle QPp can now be drawn.

Hence $P'p' = I_1 \times x_L$ where $I_1 = 13{\cdot}7$ amperes and $P'p' = 19$ volts, so that the required value of the leakage reactance is:

$$x_L = \frac{P'p'}{I_1} = \frac{19}{13{\cdot}7} = 1{\cdot}38 \text{ ohms per phase.}$$

Magnetic Developments

THE first of a new series of lectures inaugurated by the Permanent Magnet Association was recently delivered by Professor W. Sucksmith, F.Inst.P., F.R.S., in Sheffield before some 200 people representing the metallurgical and electrical industries. He traced the remarkable developments that have taken place in the theory of magnetism and its practical applications during the last fifty years. Starting from the classical work of Ewing and Weiss he touched on the developments up to the 1930's and then spoke of the parallel advances in theory and practice in the last 25 years. The latter he said had resulted in a forty-fold increase of energy of permanent magnets and a thousand-fold increase in the permeability of soft magnetic materials.

Mr. Spencer Levick, the chairman of the Association, presided at a dinner which followed the lecture and he and others paid tribute to the team spirit pervading the Association, which not only performed the functions of a trade association, but also owned its own central research laboratories and maintained an information service.

VIEWS on the NEWS

By REFLECTOR

AS an indication of American interest in the British Industries Fair, the *Board of Trade Journal* reports that one visitor from the United States asked at one stand in the Hardware Section at Castle Bromwich for a sample of everything on show. It is to be hoped that this will not become common practice unless, of course, the samples are paid for and this is not stated. Casting of bread upon the waters is all very well but the Atlantic is very wide.

* * *

Feminine interest in electricity dates back long before the inception of the E.A.W. In the *Electrical Review* of 13th January, 1888, the following note appeared:

> " Lectures by a lady to ladies on electricity are certainly a novel means of disseminating information regarding bells, batteries and dynamos; but there is no reason why a great measure of success should not be attained in this direction. With the spread of definite knowledge amongst the fair sex of the advantages and beauties of electrical appliances, electric light, and electrical methods of doing household and other work, we are sure to find an increased demand upon the services of the electrician and electrical engineer (either or both, if there be any distinction between them). Interest the ladies, therefore, in electrical matters, and they will give an adequate return by agitating for a more general adoption of electricity for light and for work. We are glad to see that so competent a lady as Mrs. Ayrton is taking the initiative in this commendable movement."

Mrs. Hertha Ayrton was the wife of Professor W. E. Ayrton and the first (and for a long time the only) woman member of the I.E.E.

* * *

Methods of cooking in an emergency, such as during an electricity failure, were demonstrated at Ipswich recently. I observe from the *East Anglian Daily Times's* account that the means adopted was to improvise an oven from a dustbin, bricks and pug (a mixture of earth and water) and to make kettle trenches for boiling dixies of water. I am glad that the likelihood of power cuts is becoming increasingly remote.

* * *

Knowing my predilection for electrical fish stories, a Wiltshire correspondent sends me a cutting from a local paper which indicates that the B.E.A. is not the only body which gets into hot water (to use an inverted metaphor) over fish. An exhibition was recently arranged at the Swindon Public Library by the local Aquarists' Society and one morning, upon inspecting the tanks, the Society's secretary found that in one of them about thirty White Cloud Mountain Minnows (I had always thought minnows were just minnows) had been " boiled alive." Apparently a thermostat had been tampered with and the temperature had risen to about 120 deg F, which was more than the fish could stand.

* * *

Cleanliness is apparently being ousted from second place to godliness in the United States. The *Economist* says that in Chicago there are now 1,360,000 television sets in use and only 1,260,000 bathtubs. In the U.S.A. as a whole there are about as many television sets as private baths—about 30 million. It looks as though the bathtub makers are not doing enough television sponsoring.

* * *

At the annual synod of the Exeter Methodist District electricity charges for churches were discussed. One speaker, as reported by the *Western Morning News*, said that " it would be best if individual circuits fought the matter out with their Electricity Boards." This sounds to me like internecine warfare.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Westinghouse Brake & Signal Co., Ltd., has promoted **Mr. N. G. Cadman**, M.I.Mech.E., M.I.Loco.E., deputy works manager, to be works manager. Mr. Cadman was educated at Skinner's School, Tunbridge Wells. He joined the Brighton Locomotive Works of the L.B. & S.C.R. as a fitter apprentice, and was later awarded a pupilship by the Railway. He entered the Westinghouse organization in 1926 as a draughtsman, and in 1929 joined the Brake Engineering Department where for some years he was in charge of all experimental brake work, including the organization in conjunction with railway engineers of the high-speed tests in 1938 on the L. & N.E.R. and also on the S.R. He was appointed chief brake engineer in 1947, and became deputy works manager (engineering) in 1950. He is a chartered automobile engineer, and a director of Hewins, Ltd.

Mr. H. Lewis, London area manager of Burco, Ltd., who recently completed 24 years' service with the company, has retired. He will continue to reside at "Pasadena," 125, Halfway Street, Sidcup, Kent.

Mr. B. A. G. MacFadden, T.D., has been appointed sales manager of the Revo Electric Company's Cooker and Domestic Appliance Department. His duties will cover both home and overseas markets. Mr. MacFadden had ten years' experience in the supply industry before joining the English Electric Co., Ltd., in December, 1938. After war service with the Royal Artillery in the rank of major, he returned to the English Electric Co., Ltd., and in his position as assistant to the sales manager, spent some time abroad. He joins Mr. P. Hartill who is sales manager on the Lighting and Industrial side.

Mr. B. A. G. MacFadden

Mr. B. N. H. Thornely, chief engineer of the Northern Aluminium Co., Ltd., has been elected to the board of the company.

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr. C. P. Storr**, M.A., M.I.Mech.E., M.I.E.E., has been appointed power systems engineer. He will be responsible, under the chief electrical engineer, for the investigation of problems of stability, load distribution, voltage regulation, and system faults, which can arise in the operation of large interconnected power networks. Mr. Storr took his degree at Cambridge and joined M-V as a college apprentice in 1928. After working as a relay engineer in the Meter Engineering Department he went to India in 1935, joining the head office of Associated Electrical Industries (India), Ltd., in Calcutta. During the war he was seconded to the Indian Ordnance Service as civilian gazetted officer, in which capacity he was responsible as works manager for the installation and commissioning of the Kanpur ordnance factory. In 1946 he was appointed deputy chief engineer, A.E.I. (India), and he became chief engineer and a director in 1949. In that year he was also made a director of Associated Electrical Industries Mfg. Co., Calcutta. Mr. Storr has been chairman of the Calcutta Branch of the Institution of Electrical Engineers and has also been a member of the Electrical Plant and Switchgear Sectional Committee and the Transformer Oil and Lubricants Sub-Committee of the Indian Standards Institution.

Mr. C. P. Storr

Mr. Kenneth J. Clarke, A.M.I.E.E., M.A.M.E.M.E., who has been on the staff of the B.T.H. Birmingham district office for the last sixteen years, has now taken up a staff appointment at the B.T.H. Sheffield district office. **Mr. J. Goldsmith,** M.A.M.E.M.E., has left the London district office of British Thomson-Houston to join the staff of the company's Birmingham district office.

Mr. David Leith, general manager of James Jones & Sons, Ltd., timber merchants and pole importers, has been appointed a director of the company.

Mr. **K. F. Shaw,** a student trainee with the Midlands Electricity Board, has been awarded the 1953 scholarship provided by the Birmingham Electric Club for part-time students of the Electrical Department of the Birmingham College of Technology.

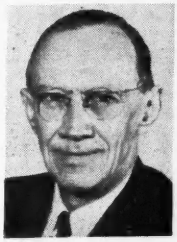
Mr. **T. R. Smith** has been appointed assistant commercial officer to the Merseyside and North Wales Electricity Board in the place of Mr. S. G. Roper who has been appointed Uxbridge District manager with the Southern Electricity Board. Mr. Smith was formerly commercial officer in the Merseyside Board's No. 4/5 Sub-Area. He joined the North Wales Power Co., Ltd., as assistant meter engineer in 1936, and six years later became power sales engineer, a position which he held until nationalization.

Mr. **Sampson Goldstone** has been elected chairman of Ward & Goldstone, Ltd.; he will continue as managing director. Mr. D. Tesciuba has been appointed a director of the company; he will continue to control the Automobile and Aircraft Wiring and Components Division.

On 30th April, 1st and 2nd May dramatic societies from various **General Electric Company's** works and offices in London and the Provinces competed in the G.E.C. Coronation Year Drama Festival, which took place at the Fortune Theatre. Plays were adjudicated by Miss Lyn Oxenford, a member of the Guild of Adjudicators. Our photograph shows Lady Railing presenting the Chelioti Cup, competed for by teams on the G.E.C. Wembley Estate, to Mr. E. Billington who produced the play " Dark Brown " by Philip Johnson, performed by the winning team, Osram G.E.C. Lamp Works.

Lady Railing presenting the Chelioti Cup to Mr. E. Billington at the G.E.C. Coronation Year Drama Festival

At the recent annual general meeting of the Batti-Wallahs' Society **Mr. A. G. Freeborn,** B.Sc., was elected president for the ensuing year in succession to Mr. J. W. Perkins, M.I.E.E. Mr. T. C. F. Bigland was re-elected as hon. secretary and Mr. J. Temple Hazell as assistant hon. secretary. Dr. L. G. Brazier and Messrs. M. D. Cloran, H. A. Crabtree, A. N. East, C. N. Good and G. H. L. Smith were elected to the Committee.



Mr. A. G. Freeborn

Mr. Freeborn spent his early life in the Mercantile Marine and the Royal Naval Reserve (during the 1914-18 war). He left the sea in 1919 and took up a post with the Victorian State Electricity Commission, Melbourne, but returned to England in 1922 to become chief assistant to the chief engineer of the Old Slough Trading Company. Then from 1925 to 1929 he held several positions in industry in this country and the United States, becoming chief engineer to John Barker & Co., Ltd., Kensington, in 1929. Mr. Freeborn remained with Barker's until the outbreak of the last war, when he became chairman and managing director of Aquastat, Ltd., which operates an electrical water-treatment process patented by Mr. Freeborn.

The next Batti-Wallahs' luncheon is on 27th May when Mr. G. F. Peirson, chief engineer, Midlands Electricity Board, will talk on " KVA in the U.S.A."

Mr. J. W. Gauntlett has been elected a director of the Calcutta Electric Supply Corporation in succession to **Mr. G. G. Phillips** who has resigned.

On 29th and 30th April the **Cambridge Instrument Co., Ltd.,** restored a very popular pre-war custom by opening its works in Cambridge to those members of the University concerned with the teaching and study of scientific subjects. Those invited included professorial and teaching staffs, research and fourth year students, senior technical staff and other senior members of College, together with civic personalities. The " At Home " was quite informal. All the workshops and research departments were open for inspection and displays and demonstrations were given of many of the company's products, including a 12-element oscillograph of the Duddell type; a universal bridge for the measurement of d.c. resistance, self and mutual inductance, capacitance and frequency; vernier potentiometer, Schering bridge; and quick acting electronic recorders for various applications. In the workshops considerable interest was taken in the high frequency

automatic soldering and brazing plant and in various special machines devised. During the two days over 800 visitors were received, including the Mayor and Mayoress of Cambridge, Heads of Colleges and Laboratories and many other prominent scientists.

A meeting was held in the ballroom of the Royal Hotel, Southampton, on 8th May for the purpose of forming an Electric Club. Mr. H. Dennis Denman gave a talk on the history and activities of the Bristol Electric Club of which he is hon. secretary and it is anticipated that the inaugural general meeting will be held in September. In the meantime the Luncheon Club which has been in existence since December, 1952, and meets on the first Friday of the month, will continue and those interested are invited to join. Information can be obtained from the secretary at 103, St. Mary's Road, Southampton.

OBITUARY

Mr. Charles B. Taylor, superintendent of the King Edward factory, Thorne, near Doncaster, of the British Thomson-Houston Co., Ltd., died on 1st May at the age of forty-seven. Mr. Taylor joined the Test Department of the B.T.H. Coventry Works in 1927, and in 1935 he was made assistant chief tester, transferring to the King Edward factory in October, 1951.

Mr. Edward Henry Lay, a member of the British Thomson-Houston Co.'s Electronics and S.R. Sales at Rugby, died on 2nd May at the age of forty-nine. Mr. Lay was born at Peasenhall, Suffolk, and was educated at Epsom College and Bristol University. He joined the B.T.H. Co. as a student apprentice in 1926, afterwards entering the company's Export Department. He later transferred to control gear sales until early 1946 when he joined the Electronics and S.R. Sales to specialize in industrial applications of electronics.

Mr. J. A. Begley, B.Sc., A.M.I.E.E., mains engineer with the Belfast City Electricity Department, died recently as the result of an electrical accident. He had been mains engineer for eighteen months and had been with the Department since 1934, when he was engaged as an engineering trainee. Mr. Begley was thirty-seven years of age.

Mr. C. W. Buckley.—The death occurred on 5th May of Mr. Charles Wilson Buckley, chairman and managing director of Santon, Ltd., and chairman of Santon (Wholesale), Ltd. Born at Aldridge, Staffs, in 1886, Mr. Buckley was educated at Walsall Grammar School and Walsall Technical College. After eleven years with the Wolverhampton Corporation, latterly in charge of the meter and test departments, he went to the Newport Corporation Electricity Department, being from 1914-19 in charge of the meter and test room. He joined with the late Mr. H. C. Sanders, who was with him at Newport, to found the firm of Santon, Ltd.

WILLS

Mr. E. Fulford, A.M.I.E.E., formerly district electrical engineer with the London and North Eastern Railway, who died on 21st October, left £6,965 gross (£4,689 net).

Mr. C. W. Glass, formerly honorary secretary of the South Western Branch of Electrical Power Engineers' Association, who died on 25th December, left £899 gross (£845 net).

Lt.-Col. S. Smith, F.R.S.A., M.I.E.I., M.Inst.B.E., of Pollard Hall, Gomersal, Yorks, a director of the Yorkshire Electric Power Co., Phelon & Moore, Ltd., etc., who died on 4th January, left £102,875 gross (£55,880 net).

PARLIAMENTARY NEWS

By Our Special Reporter

REPLYING to questions in the House of Commons last week the Assistant Postmaster General (Mr. Gammans) said that the extension of television broadcasting to new areas had hitherto been held up on the instructions of the Government on capital investment grounds. This matter was now being reviewed and an announcement would be made shortly. The question of v.h.f. broadcasting must await the decisions taken when the Television Advisory Committee had reported on this point. The Postmaster General expected to receive the report by 13th May and he hoped to publish it shortly afterwards.

Mr. Ness Edwards asked whether the present financial resources of the British Broadcasting Corporation were adequate for the completion of the low power station programme and the development of very high frequency during the current financial year.

Mr. Gammans said he understood that if prices remained reasonably stable, the Corporation's resources were at present sufficient to complete the five permanent low power television stations, but in any case the work could not be finished in the current financial year.

Precipitators at Dunston

Replying to Mr. Popplewell, Mr. Joynson-Hicks, Parliamentary Secretary, Ministry of Fuel and Power, said he was informed that the work on one of the electrostatic precipitators at the Dunston-on-Tyne power station should be completed in June and on the other in September.

Belfast Station Extension

ON Thursday last week the capacity of the Belfast power station in Musgrave Channel Road was extended by the starting up of a new 30 MW generating set by the Lord Mayor, Alderman J. H. Norritt. It was the final extension of the scheme inaugurated by the Duke of Abercorn, Governor of Northern Ireland. The Lord Mayor said that the new Victoria power station on the West Twin Island was estimated to cost between £16,000,000 and £18,000,000 and initially would have a capacity of 190 MW.

Mr. R. P. Watson, acting city electrical engineer and manager, said that the plant just put into operation was the most modern and completed the largest station in Ireland. The Department was preparing another and larger station across the Musgrave Channel and it was hoped that the first section would be ready for opening next year.

The extension comprises three boilers, a 30 MW turbo-alternator, circulating reinforcement water pumps and underground culvert. The boilers are three high-duty tri-drum Stirling type, with a maximum continuous evaporation of 150,000 lb/hour. There are two induced draught fans, two forced draught fans and two secondary air fans. Each boiler is fitted with Vortex dust collectors, automatically discharging into steel bunkers.

The turbo-alternator plant is of Metrovick construction with a maximum rating of 30 MW at 33kV, 3,000 r.p.m.

The 33 kV switchgear is of the Reyrolle duplicate busbar metal-clad compound filled pattern, so arranged that the alternator may be connected with either or both busbars.

Board and Manufacturers

AT Brighton on Monday last the tenth meeting of representatives of the South Eastern Electricity Board and of electrical manufacturers was held under the chairmanship of Mr. W. R. T. Skinner, deputy-chairman of the Board.

Opening the proceedings, Mr. Skinner reviewed the progress of the Board since its inception. He said that it started with 858,660 consumers and last October connected its millionth consumer; in five years the number of consumers had risen by 18·4 per cent and connections to farms by 42 per cent. Moreover, the existing consumers continued to take more and more; last year the sale of electricity was 60 per cent more than in the year before the Board took over.

Off-peak use was being encouraged and as a result the load factor had improved from 40 to 48 per cent. A slight recession to 47 per cent last year was due to the continuance of the ban on paper advertising.

He saw no reason why the rate of progress should not be substantially maintained and he even hoped that parts of the business would show even greater progress. They had found that unnecessarily heavy stocks were being carried and these were being dealt with. Although this would cause a temporary variation in the rate of ordering of some things, they would eventually revert to something like the normal rate.

Referring to the recommendations of the Ridley Committee, Mr. Skinner said that there was still some discrimination against electricity as compared with solid fuel, but he hoped that the electricity supply industry was doing all it could to convince the Ministries concerned of the need for freedom of competition.

We heard much of "incentives," but the electricity supply industry was expected to work and keep cheerful under endless restrictions and frustrations. It would be pleasant when the industry was encouraged in a practical way to get on with its work instead of being told that it was almost unpatriotic to be doing what it was doing.

After Mr. Skinner's remarks questions were asked and answered and Alderman E. Simms (a member of the Board) gave a short address.

Science Abstracts

FROM time to time the editor of *Science Abstracts* is asked whether an edition printed on index cards can be produced; the reply given hitherto has always been that the high cost of production and the limited circulation of such an edition would make the subscription rate prohibitively high, of the order of £40 a year for Section B (Electrical Engineering) alone. As an alternative, an edition printed on one side only was made available for anyone wanting to compile a card index of abstracts; however, a recent survey has shown that the labour of cutting and mounting single-sided issues may, in fact, raise the overall cost to a figure comparable with that of a card edition, which would, if so, be preferable for other reasons.

No precise estimate of the subscription for a card edition can be made until the probable extent of the circulation is known. To enable such an estimate to be made, the editor would be glad to hear from anyone who might be willing to subscribe up to £40 a year for *Science Abstracts*, Section B, printed on 3in by 5in index cards (address: the Institution of Electrical Engineers, Savoy Place, London, W.C.2). A similar card issue of Section A (Physics) could also be contemplated if sufficient demand was known to exist.

The I.E.E. in 1952-53

Points from the Annual Report

THE report of the Council of the Institution of Electrical Engineers for the twelve months ended 31st March was presented at the 81st annual general meeting yesterday. Membership reached 37,782, of whom 28,867 were corporate members and graduates; new members numbered 2,312, compared with 2,295 in the previous year. Other applications dealt with, mostly for transfer from one class to another, totalled 2,410. Fifteen cases of unauthorized use of membership initials were dealt with.

There were 1,262 meetings of members, the Council and committees in London and elsewhere. Attendances at the nine ordinary meetings held in London averaged 269 (289 in 1951–52). Membership of the four specialized Sections continued to grow; the largest was the Radio Section with 4,811, which held 25 meetings with an average attendance of 243 (150 in 1951–52), followed by the Supply Section (3,691 members), Utilization (3,639) and Measurements (2,150).

The ten Local Centres included 16,725 of the total I.E.E. membership, the South Midland with 3,144 being the largest. Most of the overseas committees were able to provide meeting facilities and social functions locally. The B.E.A., Electricity Boards, E.D.A., B.E.A.M.A. and C.M.A. have between them accepted responsibility for contributing £50,000, in cash and kind, for an electrical power collection at the Science Museum. Displays have been made at the Institution building dealing with the preparation and use of transparent conducting films on glass and with corrugated argon-welded aluminium sheaths for cables.

Among references to the work of numerous technical committees are several relating to Codes of Practice for Buildings, one of which (C.P. 321) is being considered for revision so as to differentiate its contents more clearly from the basic requirements for safety embodied in the Wiring Regulations. Seven Codes dealing with telecommunication installations in and about buildings have been completed. A draft Code on the Use of Electronic Valves (Parts 1 and 2) has been approved by the Council. Others under consideration relate to safety lighting and primary maintained lighting for cinemas, general aspects of radio interference abatement, earthing, overhead electric power lines, street lighting (Part 2, other routes) and electronic valves (Part 3). Revisions of regulations regarding equipment for aircraft are being drafted.

Model forms of four general conditions of contract (export delivery f.o.b., export and erection, home sales of goods excluding cables, and cables only) are being redrafted; for these the Association of Consulting Engineers is linked with the I.E.E. and the Institution of Mechanical Engineers. An extra-mural committee on electric industrial process heating has been appointed.

At the invitation of the Institution of Civil Engineers of France the third meeting of the conference of representatives from the engineering societies of Western Europe and the United States (EUSEC) will be held in Paris from 7th to 11th September next. A Commonwealth conference on electric cable standards is to be held this year.

The Education and Training Committee is considering ways of encouraging the publishing of more electrical engineering text-books, especially those of post-graduate standard. Proposals have been discussed for establishing a separate department of electronics at the College of Aeronautics.

The Council holds that there should be a larger output of applied scientists in relation to pure scientists and a greater number in the two groups together in relation to students graduating in other subjects. It welcomes the recent Government proposal for financing an expansion of the Imperial College of Science and Technology (London University) from 1,600 to 3,000 between 1957 and 1962, but considers that facilities should be widely spread throughout the universities. Technological education in a few colleges outside the universities is regarded as at least as urgent, with especial regard to the new industry-based sandwich courses.

Wages and Conditions

Discussions at E.T.U. Conference

OVER 300 delegates, including one woman member, are this week attending the annual policy conference of the Electrical Trades Union which opened on Monday at Clacton in brilliant sunshine. The first day's proceedings were marked by an unexpected ceremony in the presentation of gifts brought by a delegation from the Chinese Electrical Workers—Chang Tsan Ming, of Shanghai (president), Huang Ming Wei, of Peking (vice-chairman) and Wang Tao. The gifts took the form of a silken banner bearing a message in Chinese, a lacquer tea service and an exquisitely carved ivory ornament symbolizing the unity of peoples throughout the world in defence of peace. Other overseas representatives during the week were Mr. Bar Tel, Israeli Labour Attaché, and M. Marcel Paul, president, Federation Nationale de l'Eclairage et des Forces Motrices.

PRESIDENTIAL ADDRESS

Mr. Frank Foulkes, the general president, in his address emphasized the growing influence of the Union and the amenities provided for members, who now numbered 203,344, making the Union the seventh largest affiliated to the T.U.C. In addition to the Convalescent Home at Rustington they were shortly to have a residential college, the first possessed by any union in this country. The college, at Esher Place in Surrey, would be officially opened on 4th June and the first course would commence on 21st June.

Turning to wages and working conditions, he said that the first task facing them was resistance to a lowering of living standards. They could never agree that increased production should not be reflected in the wage packets of the workers. Profits had reached new levels and production had increased as never before, but the workers' actual standards of living had decreased. An examination of the details of the Budget showed that the only people who would benefit from increased production were the employers themselves. They had been given a bonus of £254 million a year, made up of the abolition of the excess profits levy, the increased allowance for plant replacement, and income tax relief on industrial profits.

They were faced with unemployment as a menace to wage standards. With this country free to sell in the markets of the world employment could be guaranteed for all who were willing to work. At present the North Atlantic Treaty Organization prevented their entering into ordinary trade relations with China and Russia where they could sell their engineering and textile products in exchange for grain, oil and other raw materials. Britain's survival depended on trade, not aid.

Following a vote of thanks to the president, the agenda opened with a resolution calling on the Executive Council to press for a superannuation scheme, the whole or most of the contributions being met by employers. This is a subject which has been aired at conferences for several years, the claims of manual workers to be treated on an equal basis with clerical and administrative grades being stressed. On this occasion a realistic note was brought into the discussion by a Nottingham delegate, Mr. J. E. Hobday, who said that the cost of such a scheme to nationalized bodies would be passed on to the people in the way of increased charges for electricity, gas, etc., and in the case of municipalities by higher rates. There was a section of the community which could not bear any further increases of the kind—the old age pensioners. After the Executive Council had supported the resolution it was carried unanimously.

Another resolution which received the full support of the delegates related to the " country allowance " paid in the electrical contracting industry. This was considered to be totally inadequate in view of the ever-rising cost of accommodation. For the Executive Council, Mr. R. G. McLennan outlined the steps which had already been taken and said that they had registered " failure to agree."

More contentious was the question of a national rate in each industry. The Executive Council had previously been defeated on this matter, but it again opposed the claim made in a composite resolution. Advocates expressed the view that the cost of living was as high in the provinces as in London, but Mr. Walter Stevens, the general secretary, cited figures to show that the differentials were warranted. In the case of the contracting industry the amount on paper was 5d an hour, but part of that was in lieu of travelling time. The resolution was defeated.

Tribute to Lord Citrine

On Monday afternoon the conference was addressed by Mr. R. G. Cook, secretary of the trade union side of the National Joint Industrial Council for the Electricity Supply Industry, who in the course of his remarks paid a tribute to the chairman of the British Electricity Authority. Lord Citrine, he said, had shown a great appreciation of the part that workers in nationalized industries should play. They must not underestimate the great degree of opposition he must have received from many people who occupied positions of eminence in the industry. Whatever steps forward had been achieved had been made possible by his work behind the scenes, and Mr. Cook expressed apprehension of what the conditions would be when Lord Citrine's term of office expired.

Another resolution called upon the Executive Council to press further for a sick pay scheme for all members in the contracting industry. This matter has been under consideration by a sub-committee of the N.J.I.C. which has agreed that it would be practicable to operate a scheme, after examining proposals made by insurance concerns.

On Tuesday morning the conference was addressed by Mr. Arthur Greenwood, M.P., P.C., chairman of the Labour Party, who was the guest of honour at a luncheon at the Grosvenor Court Hotel.

A resolution supporting the Executive Council's efforts in defence of the living standards of members and declaring continued opposition to any form of wage freeze or moderation was vigorously introduced by Mr. E. S. Elsom (Grimsby). Dealing with the argument of employers against conceding wage increases he contended that it was not high prices that prevented British manufacturers selling their products abroad and instanced the recent rejection of the English Electric Company's tender for the American hydro-electric plant contract. After Mr. Stevens (general secretary) had enunciated the executive's point of view and other delegates had added their support the resolution was carried unanimously.

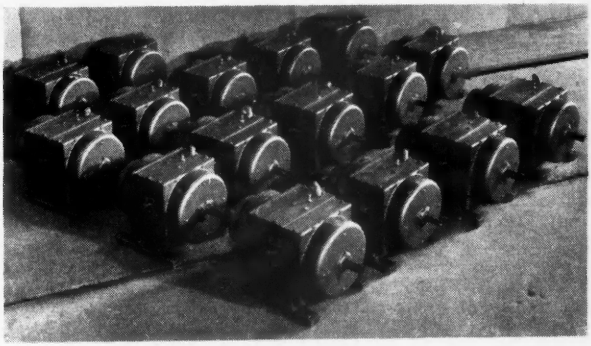
Allied to this was a motion urging that in order to prevent increasing hardships and to offset reductions in real wages there should be an escalator clause in future wage agreements with employers. The proposer was Mr. S. S. Goldberg (Birmingham Central), who said that if wages in the electrical contracting industry had followed the rising cost of living 40,000 of their members would now be £75 a year better off than in 1948. The only argument against such a clause seemed to be that if they got automatic wage increases the Unions would seem to be militant. It was not suggested that the clause should be based upon the old inaccurate index but upon a new and more realistic one. A similar motion was narrowly defeated at last year's conference; the executive again expressed its opposition and the resolution was rejected by a substantial majority.

Superannuation Scheme

When a resolution pressing for the establishment of a comprehensive superannuation scheme for the electricity supply industry came before the conference, the president announced that a scheme had been agreed with the British Electricity Authority similar to that already in operation for non-manual workers, except that it would be voluntary. The scheme had been sent to the Minister of Fuel and Power for approval.

With regard to the Union's claim to sole negotiating rights for electrical contracting members in the supply industry, the general secretary said that at the moment the B.E.A. was still insisting that if the Union wanted different negotiating machinery it must be by way of a sub-committee of the N.J.I.C. for the Electricity Supply Industry. This the Executive Council would not accept under any circumstances.

In the evening there was a reception, ball and cabaret at the Town Hall at the invitation of the Clacton U.D.C. and the Union's dance and cabaret took place on Thursday.



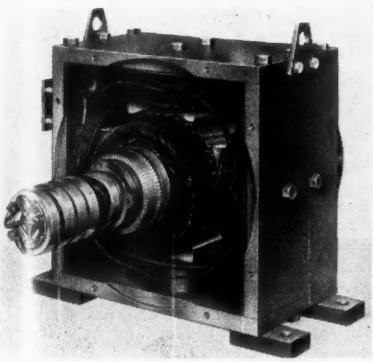
"Square Path" alternators are available in sizes from 1·5 kVA to 35 kVA

Lighting Set Development

Meeting a Revived Demand

ONE of the adverse results of the last war was the collapse of the world-wide business in electric lighting sets. The demand, from this country at any rate, revived after the war and continued in a fairly healthy state until last year when, for various reasons, probably mainly the international economic situation and competition, it almost stopped again. To right this state of affairs the British electrical manufacturers had to consider how to produce good lighting sets at the right price.

Depicting the rectangular construction of the frame



The answer of the Brush Electrical Engineering Co., Ltd., to this problem is a range (1·5 kVA to 35 kVA) of "Square Path" alternators which has just been introduced to the market from the company's Cardiff Works. The company expects to sell these mainly to the lighting set manufacturers and to the lesser developed countries, but also in considerable quantities to isolated farms in Great Britain.

The alternators are likely to be priced at about 20 per cent below the prices of comparable machines of the traditional design. The principal contributions towards the lowering of the manufacturing costs are the adoption of a square section alternator frame, as against the usual circular frame, which permits greater economy in the use of materials; the use of round pole pieces instead of square ones, demanding less copper in the coils; and the elimination of external exciters and voltage regulators. Further, the absence of the vibration-sensitive regulators means less maintenance.

The alternators are self exciting by virtue of a separate d.c. winding in the armature, and in the smaller machines (up to 6 kVA) an inherent regulation of $\pm$ 2·5 per cent at unity power factor is afforded and $\pm$ 5 per cent regulation can be obtained at from 0·8 to unity p.f. in the larger machines. The alternators are

available as single-phase and three-phase, 50 c/s and 60 c/s revolving armature machines, with generating voltages up to 700 at four-pole speeds. They are screen protected and foot mounted, and they comply with B.S.S. 168.

The magnet frame is constructed from rectangular section steel plate of ample section, forming a box-like unit of considerable strength. The poles are of solid construction and securely fixed to the magnet frame and provided with pole shoes which are accurately fitted and machined. The field windings are former wound of polyvinalacetal covered copper wire; they are fitted with insulating flanges and are securely held in position by the pole shoes.

The armature core is built up from high permeability electrical steel laminations. The a.c. winding comprises former wound coils of polyvinalacetal covered copper wire. The d.c. winding is housed in the same slots as the a.c. coils and there is adequate insulation between the two sets of windings. The commutator terminating the d.c. windings by way of milled slots is pressed on the shaft, while connections to the a.c. slip rings are carried through the conventional shaft bore.

Ball bearings housed in end-shields spigoted on to the magnet frame and a ventilating fan secured to the armature shaft and dynamically balanced with the armature are other noteworthy features of these alternators.

South African Electrical Notes

A SCHEME envisaged to supply electricity to Oudtshoorn, George and Mossel Bay by means of a 30,000 kW power station would cost £3,000,000, according to estimates by local engineers. They say further that the scheme would be feasible only if undertaken by the Electricity Supply Commission. As it would take seven to ten years to finish, it would not check the present heavy over-loading of the power stations in these towns. Meanwhile Oudtshoorn Town Council is submitting for consideration of the Administrator of the Cape Province and Escom, the report of their consulting engineer calling for urgent extensions to their own undertaking, which will cost them £476,500. Unless these extensions are undertaken immediately, to be completed by 1957, says their resident engineer, Mr. C. H. Adams, the Town Council will have to refuse further electrical connections or installations of motors or heavy apparatus.

Shortage of Qualified Engineers

Even if the maximum use was made of present training facilities, the scarcity of 2,143 qualified engineers that had existed in 1950 would be nearly doubled in 1955 and would be nearly three times as great by 1960, said Mr. H. S. van der Walt, Secretary for Education, at the Congress of the South African Association of Trade Schools, in Bloemfontein. In 1950 there were only 8,000 qualified engineers. This scarcity had to be regarded as extraordinary and fraught with serious consequences to the Union's industrial development. The great tempo of industrial development in South Africa made it essential to turn out 750 qualified engineers a year. The scarcity was in the field of civil construction and electrical engineering. It appeared that in spite of this position, present training facilities were not used to the full.

Apart from a national senior certificate course, there were no training facilities for technicians and as a result people had to be imported from overseas. He hoped South African universities would make some provision in this respect. The Government had adopted three important means of overcoming the scarcity of ordinary tradesmen: the intensive one-year training course for apprentices, the training scheme for European adult apprentices, and immigration.

Ripple Control System

A tender of £31,192 for the supply of one ripple injection plant with 5,000 relays, to enable water heaters in the Plumstead-Bergvliet district to be switched off when there are peak loads, has been accepted by the Cape Town city council. The cost of installation will bring the total estimate to £41,775. The electricity and waterworks committee reported that the cost of the first injection equipment and 5,000 relays would be recovered within three years, and that there would be a subsequent saving of £17,500 a year.

Rats Damage Electric Clocks

Rats have been putting the 123 electric clocks out of commission in the Johannesburg city hall. To rat-proof and renovate the installation will cost £1,230.

Generator Excitation

New Methods Give Close Voltage Regulation

A NEW method of alternator excitation which gives voltage regulation within ± 1·5 per cent at all loads and at any power factor with an engine speed variation of ± 4 per cent has been developed by Arthur Lyon & Co. (Engineers), Ltd., of Stamford, Lincs. This "Stamford" alternator is fundamentally different from the conventional machine at present made in this country and it is available in various sizes up to 72 kVA rating at 50 or 60 c/s, single- or three-phase. Some machines are arranged for dual frequency and dual voltage operation that is 415 V three-phase 50 c/s or 208 V three-phase 60 c/s.

In the "Stamford" alternator the conventional commutator incorporated in the self-exciting machines has been dispensed with and excitation is obtained by transforming and rectifying the a.c. output from the sliprings. By introducing both voltage and current transformers into the excitation circuit (Fig. 1) a substantially constant

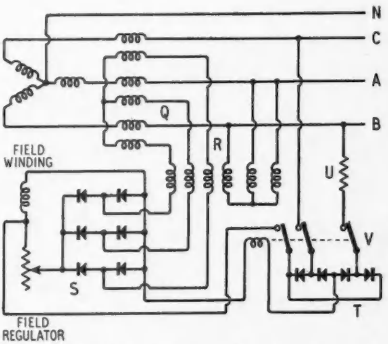


Fig. 1.—Basic circuit of the "S" alternator and its associated control gear

voltage is obtained under all conditions of load or lagging power factor.

The control circuit includes a three-phase current transformer Q, a three-phase voltage transformer R and a three-phase rectifier S. The primary windings of the current transformer are connected in the phase lines and the primaries of the voltage transformer are connected between lines. The secondaries of voltage and current transformers are respectively connected in series and the resultant current is passed through the rectifier to provide d.c. excitation for the alternator. By suitably matching the transformers and rectifiers with the characteristics of the machine the excitation is automatically adjusted to keep the voltage constant under practically all conditions of load and power factor.

The no-load excitation is supplied by the voltage transformer, but under load an additional component proportional to the load current is produced in the current transformer, thus providing the increased excitation necessary on load.

The tendency for voltage to fall with decreasing power factor is offset as follows: At unity power factor the component of the current transformer leads the component of the voltage

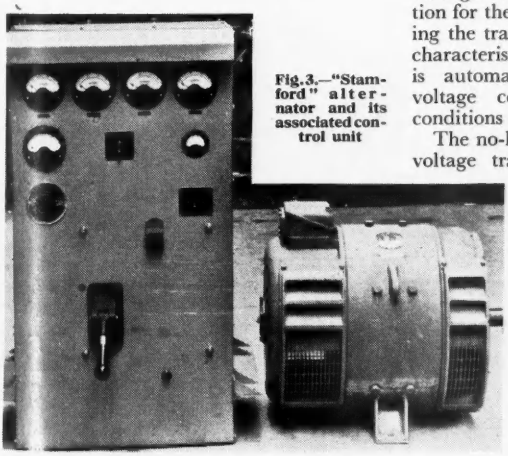


Fig. 3.—"Stamford" alternator and its associated control unit

transformer by about 90 deg (electrical), so that these two components are roughly in phase when the current lags 90 deg on the voltage and the power factor is zero lagging. Thus, as the lag of the load increases the excitation also increases, so tending to maintain the voltage constant.

This is clarified by Fig. 2 in which d is the voltage vector, f_1 the current vector in phase with the voltage as at zero lagging power factor, f_2 the current vector at power factor cos ϕ, and f_3 the current vector at right angles to the voltage as at unity power factor.

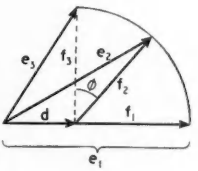


Fig. 2.—This vector explains the operation of the alternator

The resultant vectors e_1, e_2 and e_3 represent the corresponding magnitudes of the field current and since these are rectified the direction of the vector has no significance.

When starting the alternator, only a very low voltage is produced by the residual magnetism, and this is insufficient to overcome the internal resistance of the main rectifier. Consequently a small single-phase auxiliary rectifier T is temporarily connected across the field winding and is fed through a limiting resistance U from two phase lines of the alternator. This provides the initial excitation until the field current is high enough to be maintained by the main rectifier. At this point the auxiliary rectifier is cut out by a small relay V which is energized by the field current.

The current transformer embodies an adjustable air gap in the magnetic circuit which facilitates accurate adjustment to suit any change which may occur in the speed governing conditions.

By doing away with the commutator this machine has enabled the output per frame size to be increased by more than 50 per cent as compared with the conventional type of machine. The control gear is relatively simple and embodies no moving parts with the exception of relay V. All machines are suitable for use under tropical conditions.

"Birmal" Jubilee

IT was in 1900 that a shrewd Birmingham business man—Walter Maudslay—recognized the possibilities of aluminium as a constructional material and it was largely as a result of his activities that three years later the Birmingham Aluminium Casting (1903) Co., Ltd., came into being. Last week, at the Grand Hotel, Birmingham, over 250 people were the guests of "Birmal" at a celebration dinner of the golden jubilee of the company. The chairman, Lord Burghley, K.C.M.G., presided.

The toast of "The Company" was proposed by Mr. J. J. Gracie, C.B.E., general manager of the Witton works and a director of the General Electric Co., Ltd., supported by Air-Commodore W. Helmore, C.B.E., of the Aluminium Development Association. The response was by Mr. E. Player, joint managing director of "Birmal."

Proposing the toast of "The Guests" Mr. J. W. Berry, joint managing director of the company, referred to appeals for increased production; in his opinion, in view of present world conditions, it was now more important to increase the incentive to buy, and it therefore became a first duty of industry to make goods more attractive by offering better quality at lower prices. Responses to the toast were made by Mr. S. F. Burman, M.B.E., and Mr. W. C. Puckey, Ministry of Supply.

Since its formation the activities of the company have been extended to greater and more extensive fields and to-day the company is supplying the building industry with many products, the gas industry with cooker, fire and meter components, the electrical industry with motor stators and frames, switch boxes, and castings for all kinds of electrical domestic appliances, the textile industry with bobbins and reels, etc. From the magnesium "Elektron" foundry new zirconium alloys are being supplied for purposes where small weight is the first consideration.

Bomb at Power Station Site

A bomb disposal squad was called upon to detonate an unexploded 500 lb German bomb unearthed by an excavator during work on the site of the new Marchwood power station, near Southampton.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

"Domestic Socket-Outlets"

IN his interesting article in your issue of 1st May Mr. R. J. Courtenay says:

"At the same time, it must not be claimed, of course, that B.S. 1363 will take the place of B.S. 546, or that it was intended to do so. . . ."

I feel that this is contrary to the views most of us held at the time of publication of Building Study No. 11 and B.S. 1363. In this connection I would quote Mr. James R. Beard, who, writing in the *Electrician* of 28th January, 1949, said:

"'Supervisor' . . . reaches the conclusion that 'the underlying idea in the minds of the Committee was the provision of a new size socket-outlet that would in time supersede all others.' I agree the wording is not too clear in certain places, but as Chairman of the Committee which prepared this Post-War Building Study, I can confirm that 'Supervisor' has correctly interpreted the views of the Committee, which never had any other objective. It also recommends the new standard for departmental stores (para. 259), hotels (para. 269), schools (para. 345), and farm buildings (para. 400). It did not deal with industrial installations.

"The recommendations of the Study Committee were implemented in B.S. 1363, and as Chairman of the B.S.I. Electrical Industry Standards Committee I would call attention to the Foreword to B.S. 1363 which makes the position perfectly clear. It reads as follows, the italics being mine: 'the final conclusion was that a new type of "all-purpose" 3 kW (13 A at 230 V) fused-plug and shuttered socket-outlet should be *standardized for general domestic use and similar purposes.* This specification has therefore been drawn up with this object. The following British Standards for plugs and sockets are still in force and *are available for such purposes as extensions of existing installations or where a 30 A rating is required:* B.S. 196/1930;—Reversible protected two-pin plugs and sockets with earthing connections. B.S. 546/1934;—Two pole and earthing pin plugs and socket-outlets (rated at 2, 5, 15 and 30 A).'

"In view of 'Supervisor's' reference to the amended Reg. 201 (C) . . . I have confirmed that the limitation to installations in private houses and residential flats of the exemptions of this amended Regulation is related solely to the fixed wiring and to the particular diversity encountered in such premises. It would thus, as 'Supervisor' suggests, be incorrect for any intention to limit the field of use of the new plug and socket-outlet to be inferred from the wording of this amended Regulation. As far as I am aware, it is the general intention that plugs and socket-outlets to the new standard should be adopted for industrial installations wherever their use would be convenient, and there is nothing in their design which would render them unsuitable for such use."

In view of this authoritative statement, it would seem that there can be no other view than that the new standard was intended to supersede all other standards for all purposes, except for replacements and where 30 A ratings are required.

T. C. GILBERT.

Folkestone, Kent.

Are Qualifications Necessary?

HAVING read of the reorganization of one of the Electricity Boards in the current issue of the *Electrical Review*, I note with great concern that many of the executives of the districts mentioned are apparently without any of the generally accepted professional qualifications.

It would appear from these appointments that corporate membership of the I.E.E. has become of little moment and presumably qualified engineers, i.e., corporate members of professional institutions, are no longer necessary for senior positions in the industry.

Whilst qualified engineers supply only the knowledge and fall short of the managerial positions it can be forecast that in our decade no young man with aspirations and with technical, scientific or engineering qualifications will wish to enter the supply industry, and this in the face of the impetus given by local and national government to technical education.

The writer has a colleague with two sons at grammar school and he is constantly being asked why they need exert themselves to qualify for a university and take a degree

while people of their acquaintance make substantial livings without such qualifications. Such is his concern that he assures me that he will not take this week's copy of the *Electrical Review* for them to see.

There will always be men endowed by Nature with exceptional ability who will rise to positions of leadership and responsibility above their fellows, regardless of degrees or other such qualifications, but the time has surely come when public bodies such as the Electricity Boards should take the lead in accepting the standards of professional qualifications generally recognized in the electrical industry as a whole.

"VERY DISTURBED."

Committees

MAY I join the discussion on the subject of time-wasting committees? Are all these committee meetings, with their inevitable endless sterile discussions, really necessary? Perhaps Lord Citrine gave the answer before the Select Committee on Nationalized Industry last year. He may not have been referring entirely to the personnel of the bottom pyramids as contended by the *Electrical Power Engineer* when he stated that the greatest difficulty in a big organization was to get people to accept responsibility.

Mr. W. H. Dunkley's statement that the problem will be mastered by reason, eventually, is self-evident, but what are his suggestions for the acquisition of reasoning amongst the people who have the responsibility (and are paid for it) to act. What of the "youngsters" in our industry, what must they do to acquire wisdom and judgment? Bertrand Russell has stated: "Reason may be a small force but it is constant and works always in one direction, while the forces of unreason destroy one another in futile strife."

"OCCAM'S RAZOR."

Engineers' Appointments Bureau

ONCE again it is possible to report that the operation of the Professional Engineers' Appointments Bureau has been satisfactory, though 1952 was a very difficult year in many respects. Vacancies notified, registrations received and successful nominations were, in the first half of the year, above the average compared with the figures of previous years for a corresponding period, but that favourable state of affairs was not maintained during the summer months and, at the end of the year, did not show any sign of general improvement.

The Bureau has so far relied for a large proportion of its revenue on voluntary donations from industry and it has been necessary to make periodic appeals. The Board has decided that it would be preferable to institute an engagement fee to be charged to employers when an appointment results from a nomination made by the Bureau, though it is emphasized that no financial obligation is incurred by notifying a vacancy unless a successful candidate is introduced. The fee is to be based on 1½ per cent of the gross initial annual salary paid to an engineer engaged in this way and is not a departure from the policy of operating the Bureau as a non-profit-making organization.

Notifications of vacancies received during the year were 10 per cent fewer than the normal average, the total being 969 (civil 253; mechanical 482; electrical 234). The total number of nominations made was 8,751, of which 2,210 were civil engineers, 4,731 mechanical engineers and 1,810 electrical engineers. Enrolments at the end of the year were 1,975 compared with 1,679 in 1951 and 1,947 in 1952; civil engineers accounted for 476, mechanical engineers for 1,025 and electrical engineers for 474.

Since the Bureau commenced to operate, it has found appointments for over 1,250 engineers, but the number of offers made is over twice the number of acceptances because of various factors over which the Bureau has no control. For example, the salary of the new post may not be sufficient to warrant a move from one area to another, or the conditions and prospects of the appointment may appear to be unattractive.

There was a steady demand for men for appointments overseas. Several inquiries were from Canada and the United States, and as both countries offer good prospects and salaries there was little difficulty in submitting a wide selection of well-qualified candidates. A considerable proportion of the overseas vacancies notified related to posts in Africa, India, Pakistan and the Middle and Far East.

The Bureau has again made efforts to interest employers in the older engineers, but unfortunately last year the results were not quite so successful as in 1951 when over 10 per cent of the total placings were of men over 50 years of age.

COMMERCE and INDUSTRY

Iron and Steel Decontrolled

High Speed Change-over of Baker's Oven

THE Minister of Supply has made the Iron and Steel Distribution (Amendment No. 4) Order, 1953, and the Pig Iron Distribution (Revocation) Order, 1953, which terminate control over the distribution and use of those iron and steel products which were covered by the Iron and Steel Distribution Orders, 1951–3, except for material of the class of tinplate, and over the acquisition and disposal of pig iron.

Engineering Wages

At its last week's conference the National Committee of the Amalgamated Engineering Union voted in favour of backing the proposal of the Confederation of Shipbuilding and Engineering Unions that a 15 per cent increase in wages should be demanded. The president of the Union, Mr. J. Tanner, said that the claim would be based on increased productivity, increased cost of living, increased profits and "the importance of engineering in the economy of the country."

An amendment providing that the claim should be for an increase of 4d an hour was defeated as was another amendment calling for priority to be given to the settlement of a new wages structure.

A resolution was passed unanimously instructing the Executive Council to press immediately for the reduction of the working week from 44 to 40 hours without loss of earnings.

At a later session the question of wages of women members of the Union was discussed. In reply to a question Mr. Tanner said that he could give no assurance that no future wage agreement would be accepted which gave women a smaller increase than men.

The Executive Council was asked to press for a minimum rate for women not less than that for adult male workers.

The Press and the Convention

In an endeavour to interest the national newspapers and the non-electrical trade Press in the forthcoming British Electrical Power Convention (Torquay, 8–12th June) the Convention Council held a conference on Thursday last week. Sir John Hacking, president of the Convention, explained the nature and purposes of the Convention which he described as the Parliament of the electrical industry. He said that the theme of the papers was "Electricity and the National Economy."

Sir John then introduced the author of the first paper, Col. B. H. Leeson, director of B.E.A.M.A., whose subject is "Electricity and National Prosperity." Col. Leeson outlined the nature of his paper and he was followed by Mr. E. R. Wilkinson (commercial manager, B.E.A.), who similarly presented a summary of his paper on "Electricity and Industrial Production," which is to be followed by two supplementary papers. Finally Mr. S. F. Steward (chairman, South Western Electricity Board) made a lively survey of the subject of his paper, "Electricity and Food Production," which is to be followed at the Convention by three supporting papers.

Sir John Hacking, after indicating the scope of his presidential address, invited questions to which the authors replied.

Japan's Australian Tender

The Tokyo correspondent of the *Financial Times* reports that the Tokyo-Shibaura Electric Co. has submitted a tender for four turbines and generators (80 MW) for the Snowy River hydro-electric scheme, Australia. Mr. Naoshige Matsumoto, the company's chief trade manager, is said to have inspected the site beforehand and exhibited films of the Sviho hydro-electric plant on the Yalu River, Korea, for which the company was responsible.

Model Tramway Exhibition

The Tramway and Light Railway Society is holding a Coronation Year Model Tramway Exhibition from 25th to 27th June at the Royal Scottish Corporation Hall, Fetter Lane, Fleet Street, London, E.C.4, at which fifty years' history of the L.C.C. Tramways will be shown. A special feature will be a car decorated in honour of the Queen. Tickets (1s 6d for adults and 9d for children) can be obtained in advance from Mr. T. A. Gibbs, 30, Chandos Avenue, Whetstone, London, N.20.

Quick Delivery

A combined operation between the G.E.C. and Torbay District staff of the South Western Electricity Board resulted in the installation of a double-deck 36 kW baker's oven at Chelston, Torquay, in record time. The baker ordered the oven (to replace two gas ovens) only a week

before Easter and intimated that he intended to remove the first of his gas ovens on Easter Tuesday and the second very soon afterwards. A lorry loaded with the electric oven left Birmingham at 3 p.m. on 22nd April and arrived at Torquay at 9 a.m. the following day, when it was off-loaded by the Board's Torquay staff during the morning. The second gas oven was removed from the consumer's premises at the same time. The G.E.C. erector started work at 5 p.m. With the help of the Board's staff he completed the heavy erection by 10 p.m. He resumed work next day, and by 3 p.m. the oven was switched on. The work, which would normally take at least three days, was thus completed in twelve hours.

Forward Purchases of Copper

Following the Government's decision to restore copper to private trading the Minister of Supply has made the Copper, Lead and Zinc Distribution (Amendment No. 3) Order, 1953, S.I. 1953 No. 765, which allows offers or contracts to buy or sell copper for delivery after the end of public trading to be made without licence. Licences will still be needed for offers or contracts providing for delivery while public trading continues.

Llandudno Exhibition

A Brighter Homes and Hotels Exhibition, sponsored by Browns (Llandudno), Ltd., was held recently at the Winter Gardens ballroom and restaurant, Llandudno. The domestic and hotel appliances shown included a wide variety of electrical apparatus.

Lamp Display Piece

The accompanying picture shows an attractive full-colour display piece prepared by Crompton Parkinson, Ltd., to demonstrate their new "Colourglaze" lamps. "Colourglaze" is a polished glass finished in red, white, blue, yellow and green, and does not collect dust or grime.

B.N.E. Competition Result

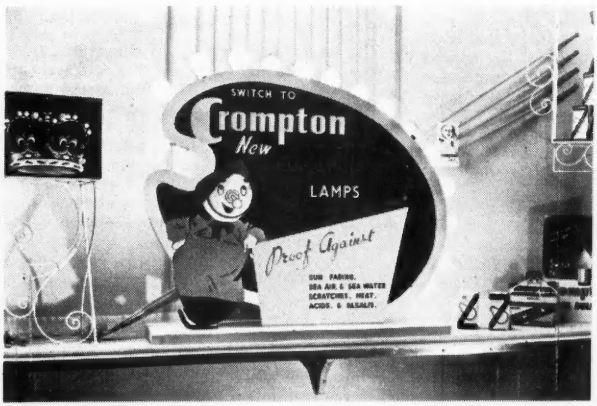
British National Electrics, Ltd., reports that the total number of entries received for its recently sponsored "all-electric ideal home" competition, ran well into five figures. The adjudication took place on 10th April at the Savoy Hotel, the adjudicating committee comprising Dame Caroline Haslett (director, E.A.W.), Miss P. L. Garbutt, A.R.I.C. (Principal, Good Housekeeping Institute), and Miss Mary Gilbert (Women's Public Relations Officer, E.D.A.). The winning entry was submitted by Mr. W. Staples of Folkestone. The best entry in the junior section of the competition was sent in by ten-year-old Richard Timberlake of St. Annes-on-Sea.

Coronation Decoration Lamps

Convenient packs of "Osram" red, white and blue decoration lamps have now been produced by the General Electric Co., Ltd., to enable existing Christmas-tree sets of coloured lamps to be re-lamped for the Coronation. With these packs, twelve 20 V 3 W olive-shaped lamps, comprising four of each colour, are contained in a neat and attractive display carton. The price of the box of twelve lamps is 14s 6d including purchase tax. Individual lamps may be purchased at 1s each, plus 2½d purchase tax.

Cathode Ray Tube Works

The Board of Trade has approved the building, under the Distribution of Industry Acts, of a Government-financed factory of approximately 250,000 sq ft in the new North-East Lancashire development area. The factory, which is to be built by North-Western Industrial Estates, Ltd., and let to the Mullard Co. for the manufacture of cathode ray tubes, will give employment to several hundred workers. The scheme will considerably increase the Mullard Company's production of television tubes and much of the existing production, which is at present carried out in the London area, will be transferred



A new Crompton "Colourglaze" lamp display piece

to the new factory. The company's factory at Blackburn nearby will provide certain materials, component parts and services for the new factory.

Defence of the Trolley-Bus

Referring to a report in the *Recorder* about the possible supersession of some of London's trolley-buses by diesel-engined buses, the British Electrical and Allied Manufacturers' Association has sent the newspaper a reasoned argument for the retention of trolley-buses. The statement, which appeared in the *Recorder* of 9th May, should help to convince the public that on economic grounds, as well as in respect of comfort and convenience, the trolley-bus is superior to the oil-engined vehicle.

New B.T.H. Irish Factory

The British Thomson-Houston Co., Ltd., is to erect a new factory at Larne, Northern Ireland, which will be concerned with the manufacture of components associated with turbine production, and will provide much-needed additional capacity required to cope with the demands for heavy electrical plant. The first stage will cover approximately 80,000 sq ft of floor space, employing at the commencement about 250 workpeople. Arrangements for ample extensions as and when required have been made. Until the new factory is available, existing premises in Larne are being rented in order to train labour and start production.

Substation Fatality

While carrying out maintenance work on a transformer at a substation at Cinderford, Dennis Gwynne (33), a jointer employed by the Midlands Electricity Board, received a shock and died later in hospital. At the inquest another jointer said that there was water in the transformer and to prevent a breakdown they started to clean it out. It was thought that there was only one lead into the transformer and as the switch for this was "off" the transformer was believed to be "dead."

"Stott Press"

We have received a copy of the first issue of "Stott Press," the new house organ of Jas. Stott & Co. (Engineers), Ltd., Oldham, manufacturers of gas governors, lighting, heating and ventilation installations. This includes illustrated details of some of the company's products and particulars of its new factory at Rose Mill, Oldham.

Electrical Housecraft

The Caroline Haslett Trust announces the award of its six most recent scholarships and invites applications for the award of the 1953 Travelling Exhibition which will entitle the holder to study, for a period of one to three months, some aspect of domestic electrification in another country. Applicants must hold the E.A.W. Diploma in Electrical Housecraft; the relevant forms, which must be returned before 30th May next, are obtainable, together with further particulars, from 35, Grosvenor Place, London, S.W.1. The scholarship awards were made to Miss Anne Cartwright (Morecambe), Miss Patricia Graham (Peak Dale, Stockport), Miss Joan Hynes (Mt. Hawke, Truro), Miss Ann Priestly (Halewood, nr. Liverpool), Miss Dorothy Tizzard (New Malden, Surrey) and Miss Elizabeth Pollard (Coventry).

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	.. ..	ton £161 0s 0d
COPPER, H.C. Electro	.. ..	ton £253 0s 0d
Fire Refined 99·70 per cent	..	ton £252 0s 0d
Fire Refined 99·50 per cent	..	ton £251 0s 0d
COPPER Tubes	..	lb 2s 6¾d
Sheet	.. ..	ton £3 16 10s 0d
H.C. wire and strip	.. ..	ton £282 15s 0d
LEAD, English ..	.. ..	ton £78 10s 0d
Foreign	.. ..	ton £77 0s 0d
MERCURY	.. ..	flask £70 10s 0d
TIN	.. ..	ton £730 0s 0d
ZINC, G.O.B. Foreign	.. ..	ton £69 0s 0d
Electrolytic ..	.. ..	ton £68 5s 0d
BRASS Tubes ..	.. ..	lb 2s 1d
Sheet	.. ..	ton £241 0s 0d
Wire	.. ..	lb 2s 6¼d
PHOSPHOR BRONZE		
Wire	.. ..	lb 3s 9¾d
RUBBER, No. 1 R.S.S. spot	..	lb 20¾d–21¼d

British Industries Fair

What may be regarded as an official appraisement of results at the Castle Bromwich section appears in the *Board of Trade Journal* which says that in the Electrical Section manufacturers of domestic equipment were having to work hard to sell their goods but were "reasonably optimistic" about the results. Several large overseas orders were taken; a Leicester firm, for example, had an order worth £35,000 for refrigeration equipment for Barcelona and orders from other countries, including Uruguay. In the same section makers of producers' equipment, such as plastics machinery, realized that they were still in a sellers' market.

Annual Holidays

The works of the Telegraph Construction & Maintenance Co., Ltd., and Submarine Cables, Ltd., will close for the annual holiday from 17th July to 4th August.

E.A.W. Stockton Branch

The Stockton-on-Tees Branch of the E.A.W. held its 21st celebration dinner on 28th April when the President, Mrs. W. W. Walton, was in the chair. The toast of the Association and the Branch was proposed by Mr. H. H. Mullens

(chairman, North Eastern Electricity Board), to which Dame Caroline Haslett (Director, E.A.W.) replied. The toast of the guests was proposed by Mr. N. Hunter (District Commercial Engineer, N.E.E.B.), and Alderman M. M. Kelly, deputy mayor, responded.

Components at the B.I.F.

In the article on wiring and components at the B.I.F. in our 1st May issue it was stated that a 15 A 3-pin ejector plug of Clang, Ltd., would shortly be in production and that a 5 A size was already available. Actually the reverse is the case, and the inversion is regretted.

Trade Announcements

Mr. G. Sanders of 21, Riddrie Knowes, Glasgow, has joined **Ashley Accessories, Ltd.,** as their representative for Scotland.

Mr. N. Sharples, representative for the Yorkshire area for **Bill Switchgear, Ltd.,** is removing on 18th May to 30, Nursery Lane, Alwoodley, Leeds.

A. S. Duran & Co., Ltd., electrical wholesale distributors, Reading, have opened a new wholesale depot at 58, Western Street, Swindon, Wilts. (telephone : Swindon 4864).

E. K. Cole, Ltd., has appointed Mr. E. H. James as technical sales representative, "Thermovent" heating. He will operate from the London office, 5, Vigo Street, W.1, and will cover the area comprising the E.C., W.C. and W. postal districts and the northern postal districts served by the London Electricity Board.

Catalogues and Lists

V. & E. Friedland, Ltd., Macclesfield, Ches.—Illustrated catalogue (in English, French and Spanish) of the company's complete range of bells, buzzers, bell pushes and transformers, etc. Also an illustrated folder dealing with the "Westminster" eight-note door chime.

Franco-British Electrical Co., Ltd., 15-17, King Street, St. James's, London, S.W.1.—Lighting catalogue introducing a new range of fluorescent lighting units.

Wolseley Sheep Shearing Machine Co., Ltd., Electric Avenue, Witton, Birmingham, 6.—Illustrated folder on the "Wolseley" electric fencers together with accessory list.

J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham, 11.—Publication G.55 giving details of a selection of recent additions to the range of "Tucker" installation material.

Nettle Accessories, Ltd., Harper Road, Wythenshawe, Manchester.—28-page illustrated catalogue of "Nettle" shockproof quick-wiring electrical accessories.

Merlin Mouldings, Ltd., 3, Central Parade, Bromley Road, Catford, London, S.E.6.—Illustrated priced leaflet of the new "Merlin" fluorescent unit.

Perfex Accessories, Ltd., Bridge View Works, Borough Hill, Croydon, Surrey.—Priced leaflet illustrating the "Osmor" metal hole cutter.

John Yuille (Metal Works), Ltd., Scottish Industrial Estate, Hillington, Glasgow, S.W.2.—72-page handbook on the "Metwul" air filter together with technical data and references.

Standard Telephones & Cables, Ltd., Connaught House, Aldwych, London, W.C.2.—Booklet on control desks for telecontrol systems (DRC.23) and an illustrated catalogue relating to direct wire alarm systems (DRC.1).

Fine Wires, Ltd., Grove Road, Castle Boulevard, Nottingham.—"Fine Wire Data"—a set of tables referring to textile covered winding wires, ec.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates mentioned:—

29th May

VICKERS. No. 702,666. VICKERS (design). No. 702,668. Class 9. Fitted electrical control panels for hydraulic systems, being goods for sale in England, Scotland and Wales.—Vickers Incorporated, Detroit, Michigan, U.S.A. Address for service, c/o W. P. Thompson & Co., 12, Church Street, Liverpool, 1.

BRIVAR. No. 706,348, Class 9. Electric cables, insulated wire and electric fuse wire.—British Valve & Electrical Accessories Manufacturing Co., Ltd., 19, Cropley Street, London, N.1.

SUBNITRON. No. 711,865. GRAVITRON. No. 711,866. Class 9. Electronic discharge tubes (not for lighting purposes).—Societé Francaise Radio-Electrique, Paris, France. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

STAT-ARC (design). No. B709,707, Class 9. Metal arc rectifier welding apparatus.—Hirst Electronic Development, Ltd., 29, Dermody Road, London, S.E.13.

CLEARWAY. No. 715,862, Class 9. Bells, bell systems, and parts of these goods, and fittings therefor, all included in Class 9.—Gillett & Johnston, Ltd., 7, Union Road, Croydon, Surrey.

PRECISTOR. No. 715,909, Class 9. Electrical resistances.—Electro-Thermal Engineering, Ltd., 270, Neville Road, Forest Gate, London, E.7.

NEPTRON. No. 714,105, Class 10. Diathermy instruments and apparatus, all for medical and surgical use.—New Electronic Products, Ltd., 111, Glasgow Terrace, Grosvenor Road, London, S.W.1.

DEMISTAIRE. No. 714,875, Class 11. Electric heating elements included in Class 11.—Tudor Accessories, Ltd., Benlow Works, Silverdale Road, Hayes, Middx.

TWYNITE. No. 715,751, Class 11. Electric lamps.—British Electric Lamps, Ltd., Spencer Lamp Works, Spencer Hill Road, Wimbledon, London, S.W.19.

6th June

ASHLEY (design). No. 715,230, Class 9. Switches, fitted switch holders, plugs, sockets, connectors, bayonet cap adaptors, junction boxes, bells and buzzers, bell transformers and terminal blocks, all being electrical goods.—Ashley Accessories, Ltd., Morecambe Road, Ulverston, Lancs.

TRANSMISSION LINES AND TOWERS

C.I.G.R.E. Visitors to England

FEATURES accompanying the meetings of C.I.G.R.E. Study Committees No. 6 (Bare Conductors and Mechanical Calculations of Overhead Lines) and No. 7 (Transmission Towers and Tower Foundations) in London last week were visits to some scenes of British transmission developments. One was a Thames journey to Tilbury to see the early stages of the construction of the first section of the B.E.A. 275 kV grid (with provision for later conversion to 380 kV).

This section, leading particulars of which were given in the *Electrical Review* of 2nd January, forms part of a double circuit line now being run from a new power station at Tilbury to a main substation at Elstree after skirting the northern suburbs of London. The towers were designed by Blaw Knox and tested by Painter Bros.; the conductors are being supplied by the Aluminium Wire and Cable Co. and the insulators by Pilkington Bros. The main contractors are the J. L. Eve Construction Co. Contracts for other sections of the 275 kV grid have been let to the British Insulated Callender's Construction Co., Watshams, Ltd., W. T. Henley's Telegraph Works Co. and Balfour, Beattie & Co.

Tower Testing

Another visit was to the tower testing station of Painter Bros. at Hereford, where the steel fabrication and general galvanizing plant have recently been considerably extended. The testing equipment includes three anchor structures staggered in relation to an adjacent reinforced concrete test bed to enable normal horizontal tower loads and broken wire conditions to be reproduced.

Towers up to 115ft high and those of unusual profile can be accommodated. Electric winches at the base of each structure impose horizontal loads up to 30 tons on one cross arm and permit of fine adjustments when reaching the limit of endurance of a tower under test. Tests are supervised from a control room, which gives an uninterrupted view of the testing plant and is equipped with instruments indicating the loads which are being applied at any point.

The committee members had an opportunity of witnessing a test on a prototype (112ft 6in) tower of new design, in which the bracing members are of mild steel seam-welded tubes, $\frac{1}{8}$in minimum thickness and galvanized without and within by a hot dipping process. The total weight of a standard tower of 136ft 6in would be 9·35 tons against 11 tons for the Tilbury type, which has open sections throughout—about 60 per cent of high tensile steel (B.S. 548) and the remainder of mild steel (B.S. 15). High tensile steel angle sections are still used for main leg and principal cross-arm members.

Operation Under Adverse Conditions

The experimental tower, however, failed to withstand the rigorous test necessary to ensure the requisite standard of reliability under adverse service conditions. Its designed duty, like that of the successfully tested Tilbury type, is to support a double-circuit 275/380 kV line, with two conductors per phase, at 12in spacing, made of steel-cored aluminium of 0·4 sq in copper equivalent (54/·125 in Al over 7/·125 in steel) and an earth wire of 0·175 sq in copper equivalent (30/·110 in Al and 7/·110 in steel) for a normal span length of 1,200ft. Maximum working tension is 12,000 lb (24,000 lb per phase) for conductors and 8,000 lb for the earth wire. Loading is taken at $\frac{1}{2}$in radial ice with 8 lb/sq ft wind pressure.

The principal social function of the week was a reception in London on 6th May by Mr. P. V. Hunter (chairman, British National Committee) and Mrs. Hunter. At the dinner which followed, the chairman proposed the health of "The Guests," congratulating Mr. G. Silva (Italy) on his election as vice-president of the C.I.G.R.E. Responding Mr. J. Tribot Laspière (France) mentioned that Mr. Hunter and Mr. R. A. McMahon had been members from the foundation of C.I.G.R.E. in 1921. Messrs. Silva and Bianchi di Castelbianco (Italy) and Mr. McMahon (secretary, British National Committee) also spoke.

Engineering in Europe

Survey of Current Literature

THE importance of the principle of splitting up the phase conductors into groups for the purpose of high-power long-distance transmission at 220, 380 and 400 kV is no longer disputed, although previous theoretical and experimental investigations of the characteristic parameters of lines with grouped conductors did not quite agree. The fundamental problems are restated and simple and correct formulæ derived by the author of this article. It is clear that the inductance per phase is increased by splitting up the conductor into a group, which leads to a reduction of the characteristic impedance and a corresponding increase of the natural power of the line.

A simplification in the computation of the actual parameters of a group is obtained by introducing the concept of the " effective radius " of the group, this being a limiting value for a group of infinitely many conductors. If the actual number of conductors is sufficiently high, their mean geometrical spacing becomes also identical with the " effective radius." The critical visual corona voltage is calculated for groups of any number of conductors in various geometrical arrangements and the relations between natural power, reactance and capacitive susceptance versus conductor numbers, arrangements and spacings are presented in useful graphs and simplified formulæ.—" Electrical Characteristics of Transmission Lines with Grouped Conductors," N. F. Rakushev, *Elektrichestvo*, No. 2, pp. 7–13, 1953, in Russian.

Tropicalization Tests

Tropicalization tests are mainly concerned with the resistance of the materials and apparatus to heat, moisture, fungi and insects, and to saline mists. The comprehensive tests carried out by French research organizations dealt with protective coatings (mainly on a plastic base), paints, varnishes and insulating materials, and with wires, cables, l.v. and h.v. apparatus, measuring instruments, radio equipment and motors. The test cycles were worked out very carefully to simulate service conditions in various tropical climates as faithfully as possible. The results, given in tabulated form, were satisfactory except for minor points, e.g. the terminals and screwed-on elements are often badly finished; unprotected metals, whether iron, copper or cadmium-plated, should be avoided. Measuring instruments should be sealed hermetically and their screws, etc., protected. Some improvements in the test cycle of the " Union Technique de l'Électricité " are suggested.—" Tropicalization Tests on Electrical Equipment," A. Delriev, *R.G.E.*, Vol. 61, No. 12, pp. 551–559, December, 1952, in French.

Capacitor Distribution

A main reason for using static capacitors is their economic effect of reducing the losses in a power system. A problem the designer has therefore to solve when dealing with the compensation of the system is how to distribute the capacitors so as to obtain the maximum reduction of the active power losses. A general rule is to place the capacitors as near as possible to the consumers. Where groups of medium- or low-power motors are to be supplied, this means that the capacitors should be connected to the group distribution board, because it is less satisfactory and often difficult to distribute them on the individual motors. However, the distribution problem is susceptible of a clear theoretical solution which, obviously, is connected with the determination of the size of the capacitor units. The theory given and examples calculated clearly show the economic and technical superiority of decentralized compensation and the considerable loss reduction obtainable by it compared with centralized compensation.—" Distribution of Capacitors in a Power System," V. S. Listvin and K. A. Parfenov, *Prom. Energ.*, No. 12, pp. 18–20, 1952, in Russian.

Readers who require accurate full translations of any of the articles abstracted in this section can be put in touch with the translators who will supply them at current rates. —Editors, *Electrical Review*.

ELECTRICITY SUPPLY

Substitute for Machen Station

Flood Damage Claims

WE reported last week that the Minister of Fuel and Power had been unable to give his consent to the building of a new power station at Machen (Mon.). The British Electricity Authority says that in consequence of this decision, alternative arrangements will have to be made and there will certainly be delay. Present-day conditions are such that two years may elapse before the necessary approval and consent for building a power station on an alternative site can be obtained. Actually, the first steps in the procedure to obtain the necessary approval and consent for a station at Machen were taken in December, 1950—over two years ago.

The Authority says that it will take expeditious steps to develop an alternative scheme, but feels bound to point out that since it is now precluded from carrying out the scheme which is most technically advantageous and economical, the alternative plan is certain to be more expensive.

Power Supply in the Shetlands

The North of Scotland Hydro-Electric Board has made an electricity supply available for the first time on Bressay, one of the Shetland Islands, and the first subscriber, a herring gutting factory, was connected on 7th May. Power from a diesel generating station at Lerwick is transmitted through a submarine cable, about 500 yd long, laid across Bressay Sound from Point of Scotland, on the mainland, to a point near Heogan where the factory is established.

The cable, a three-core 0·04 sq in 11 kV p.i.l.c. s.w.a. cable manufactured by British Insulated Callender's Cables, Ltd., was laid by the B.I. Callender's Construction Co., Ltd. This is the third of the islands which the company has connected with the mainland by submarine cable.

Repairing Flood Damage

Details of the financial assistance which the Government is to give to local authorities in areas which suffered damage during the East Coast flood disaster are contained in a circular sent to them by Mr. Harold Macmillan, Minister of Housing and Local Government. Among the claims which will be met in full are those for expenditure on or in connection with first-aid repairs to privately-owned houses. Repairs to electrical installations up to the mains, where this is the responsibility of the tenant or owner, if likely to have been permanently affected by flood water, should be regarded as part of first-aid repair and the Electricity Boards have been asked to submit all bills for this work to the local authority for payment. This arrangement does not cover fittings and appliances.

Coronation Floodlighting

It was announced by the Ministry of Works last week that more than twenty London buildings and monuments would be floodlit for the Coronation period, beginning on 2nd June and continuing for at least two weeks. In addition to the buildings for which the Ministry is responsible other buildings in London will be floodlit by the L.C.C. and Westminster City Council.

Overhead Lines Across Estate

An offer by the Midlands Electricity Board to move, free of charge, towers carrying overhead lines across a housing site if the houses were not supplied with gas was further discussed at the last meeting of the Stone Rural District Council. The Housing Committee reported it had been informed that the Electricity Board was under an obligation to move the towers without charge irrespective of any conditions. The Council decided to make inquiries regarding the legal position and also to take a census in the Eccleshall district to ascertain tenants' preferences for gas or electricity, or their desire for both.

Prepayment Meters

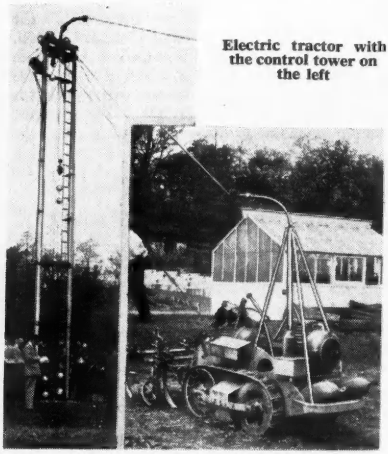
Speaking at a meeting of the Blackburn District Committee of the North Western Electricity Consultative Council, Ald. J. Herbert said that many people were used to slot meters and would prefer to retain them. Ald. F. Kenyon, chairman of the Consultative Council, said that in genuine cases of hardship the Board would install prepayment meters, and Mr. R. H. Harral, sub-area manager, stated that no prepayment meter had been changed for a credit meter without the consumer's consent.

Research in Rural Electrification

"Open Days" at E.R.A. Field Station, Shinfield

A GREAT deal of interesting research work on the applications of electricity to agriculture and horticulture is being carried out at the British Electrical and Allied Industries' Research Association's Field Station at Shinfield, near Reading, and to give both members of the E.R.A. and others interested in the subject an opportunity of seeing something of this work a series of "open days" was held last week (4th–8th May). At the opening ceremony on 4th May, Mr. C. T. Melling, chairman of the E.R.A., introduced Mr. G. R. H. Nugent, Parliamentary Secretary to the Ministry of Agriculture and Fisheries, who emphasized the importance to farmers of the work which was being done at Shinfield. He added that much still remained to be done, remarking that only 34 per cent of the farms in this country had electricity and most of the load was domestic. A vote of thanks was proposed to Mr. Nugent by Dr. S. Whitehead, after which Mr. E. W. Golding gave visitors a brief description of the work of the Station.

The grounds of the Field Station occupy an area of some three acres and are divided into two parts, one accommodating laboratory and workshop buildings and a larger one on which the horticultural researches are undertaken. There are two laboratory buildings and a small building housing a heat pump installation.



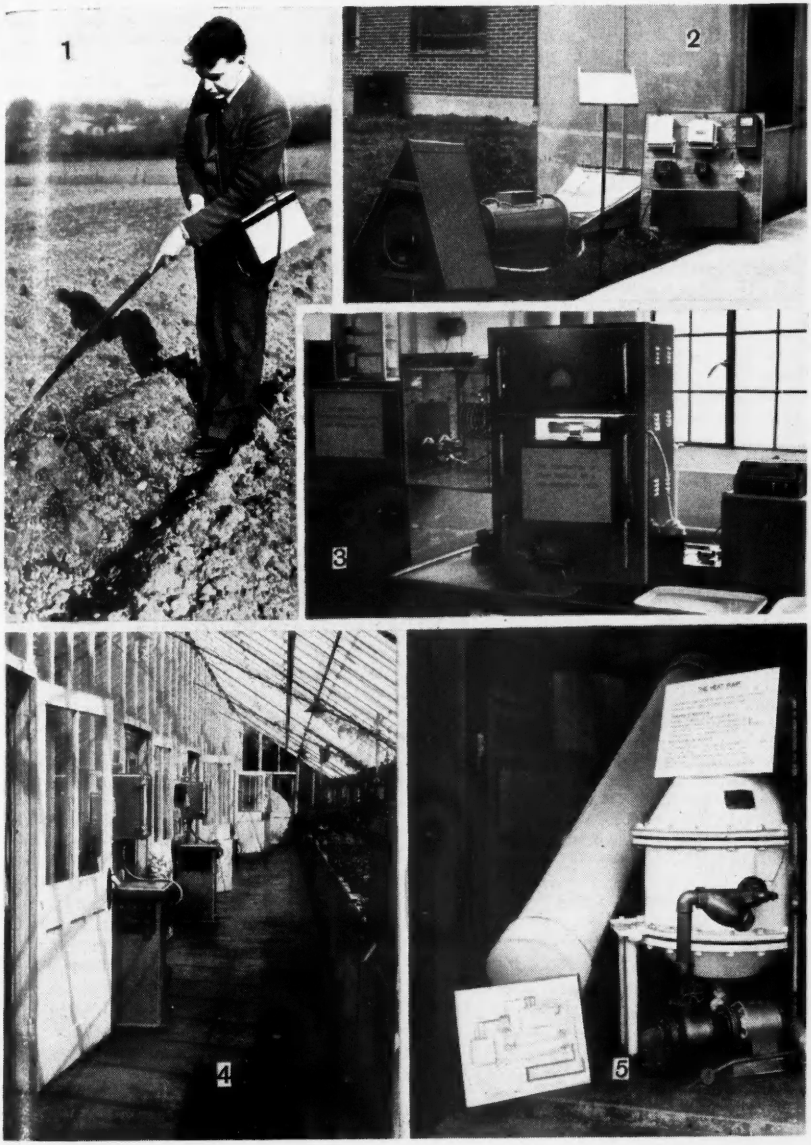
Electric tractor with the control tower on the left

The gardens have experimental plots laid out with Dutch-light frames, or cloches, and others where the crops are uncovered. Most of these plots have electric soil warming. There are two main greenhouses divided internally into compartments for experimental purposes, and also three smaller greenhouses.

Last week a display was arranged in two marquees to show some of the Station's past achievements, to indicate the nature of the researches now in hand and to suggest some possible future developments in the application of electricity to horticulture and agriculture.

Among the researches concerned with barn and field equipment now in progress are investigations into basic crop drying and electrical methods of seed drying and the killing of plants. Applications concerned with livestock include the effect of temperature and relevant humidity on growth rate and general development of chicks, the application of the heat pump principle to milk cooling and water heating and the effect of flash illumination on laying poultry. Horticultural applications under investigation include artificial illumination, electric heating of glasshouses, sterilization of soil in situ by the electrode method using low voltage a.c., and the effect of soil warming on soil temperature. Other work is concerned with the physiological effect on fish exposed to electric currents, and pest destruction by h.f. fields. Another part of the display is devoted to wind power.

An interesting item on view was an electrically operated tractor which has been in use for the past four years for all the normal cultivation and haulage work. The radius of operation from the control tower is about



(1) Portable equipment for killing weeds electrically. (2) Portable experimental seed dryer. (3) Apparatus for investigating pest destruction by h.f. fields. (4) One of the two main greenhouses. (5) The heat pump installation

110 yards, thus enabling it to cover a square holding of 5 acres. The purpose of the present investigation is to find a means of getting the supply to the tractor. No attempt has been made to design an electric tractor, the present machine being an adaptation of a well-known petrol driven model.

The specification for a suitable cable has already been drawn up and three designs are under test or being manufactured. It is evident that the higher initial cost of the electric tractor and tower would undoubtedly be offset by the reduced running costs, ease of starting and handling, quietness and low maintenance costs.

The control of biological pests is of great importance since 30 to 40 per cent of the total production of foodstuffs is lost by insect attack in the field or after harvest. In the laboratory it is shown that the application of h.f. electric fields to the infected material in many cases overcomes this difficulty since the insects can be heated to destruction without undue temperature rise of the host substance.

The heat pump installation has been made with the double purpose of heating the newer laboratory building and affording experimental data. The two laboratory buildings have been made to have similar thermal characteristics so that the performance of the heat pump can be compared with more conventional methods of heating. The low temperature heat source is the surrounding ground from which brine tanks collect the heat.

The heat pump is driven by a 7·5 kW electric motor, but the power available for heating the laboratory has been as much as 28 kW representing a performance energy ratio of 3·8. The heated water is stored at a temperature of 120–125 deg F in an insulated tank and circulated round panel type radiators under the control of a time switch.

Danish Electrical Trade

LAST year Denmark's electrical trade as a whole differed little in value from the 1951 total. Exports, at kr. 143,776,000, were only slightly higher than in the previous year, while imports aggregated kr. 115,110,000 or a little less than in 1951.

The chief items in 1952, with notes of increases or decreases on 1951, are shown in the accompanying table. Noteworthy increases on the export side were recorded in cable, vaccum cleaners, etc., signalling and alarm apparatus and power plant. At the same time imports of the last-named also increased and stood at about the same value as exports. There was a big rise in purchases of telegraph and telephone material from abroad, while those of cable fell steeply.

Last year the chief suppliers of electrical goods generally to Denmark were West Germany, Holland and the United Kingdom while her principal customers were Sweden Norway, Finland and Holland.

Class of Goods	Exports		Imports	
	1952 kr. (000)	Inc. or dec. on 1951 kr. (000)	1952 kr. (000)	Inc. or dec. on 1951 kr. (000)
Dynamos, motors, convertors, etc.	18,044	+ 6,564	18,279	+ 2,975
Battery parts	11,169	− 3,048	795	*
Incandescent lamps	1,058	+ 168	6,507	− 31
Radio valves	1,423	+ 877	4,202	− 640
Radio material	24,006	− 16,194	13,002	+ 6 [illegible]2
Telegraph and telephone material	2,026	− 567	18,170	+ 13,2[illegible]1
Cable and wire	16,737	+ 8,707	7,802	− 13,0[illegible]6
Vacuum cleaners, etc.	8,067	+ 2,224	1,411	− 7
Elec. heating apparatus	587	+ 59	1,683	+ 1
Elec. signalling and alarm apparatus	7,960	+ 1,324	4,656	− 4[illegible]3
Electro-medical apparatus	2,635	+ 1,064	3,732	− 1,5[illegible]3
Elec. material, unspecified	47,818	+ 501	28,086	− 4 1

* Comparative figures not available.

SALES AND SERVICE

This Week's E.D.A. Conference

LAST Tuesday, at Caxton Hall, Westminster, Dr. P. Dunsheath, C.B.E., president of the British Electrical Development Association, opened an electricity sales and service conference organized by the Association. Dr. Dunsheath also presided during the reading and discussion of the first paper, "Load Factor Improvement" by Mr. W. Gilchrist, A.M.I.E.E., M.I.H.V.E., chief commercial officer, Merseyside and North Wales Electricity Board.

In this paper the author briefly explained the effect of load factor upon electricity prices and differentiated between "natural" and "developed" load factor, the latter being a matter for the supply undertakings. Mr. Gilchrist also touched upon the nature of the national load and the loads of the Area Boards under summer and winter conditions.

He went on to show that most of the domestic load was actually off-peak and, analysing a particular Board's domestic load, indicated that of an average load per consumer of 0·44 kW only 0·17 kW could be attributed to space heating. From this he urged that the industry should encourage the use of electric fires for supplementary or short-period heating.

By the use of storage capacity, water heating could form a valuable off-peak load. Supplies to new housing estates were adversely affected economically by the loss of the cooking load.

The load factor of the average commercial consumer was inherently poor but off-peak methods of space heating and water heating could be fostered, particularly by properly-designed tariffs.

There was a wide variation in the load factors of industrial consumers and low group load factors could not be improved by the development of the ordinary lighting and power loads. Better conditions could be attained by the replacement of processes by more efficient electrical methods, especially in the field of process heating, by more careful planning of certain methods and by the use of electricity for producing small quantities of steam or hot water in summer when the main heating and hot water plants could be shut down.

At present the load factor of the agricultural industry was poor but by virtue of long hours and diversity of use it could make a valuable contribution towards the high cost of rural electricity supply.

The author then considered the design of "off-peak" equipment, covering such systems as floor warming and thermal storage block heating; electric water heating in conjunction with solid fuel; refrigeration in relation to the heat pump; and central heating services for blocks of flats.

In a section on load control to improve load factor Mr. Gilchrist expressed a favourable view of ripple control and suggested that for the control of storage heating consideration would have to be given to multiple time/temperature thermostatic control.

It was necessary to examine the relative costs of on-peak and off-peak supplies and to evolve tariffs related to these costs, competitive with other fuels and giving an overall economy to the consumer. The author showed that the trend of the new standard tariffs was to increase the price of low load factor supplies and to relate charges to costs for each class of consumer and type of load. He concluded by showing that electricity was favourably placed in competition with gas and coal and with informed salesmanship there could be a very considerable expansion of the electricity supply industry.

Commercial Development

Mr. T. E. Daniel, M.Eng., A.M.I. Mech.E., M.I.E.E., presided at the Tuesday afternoon session, when a paper entitled "Basic Data in Commercial Development: A Comparison of Three Industrial Sub-Areas" was presented by Messrs. W. E. Swale, M.I.E.E., A.M.I.C.E. (N.W. Electricity Board, Manchester), I. M. Smillie (N.E. Electricity Board, Tyne) and G. L. Tomlinson, A.M.I.E.E. (Yorkshire Electricity Board, Sheffield).

The paper was largely statistical, and

among the matters established by the authors was the necessity for a balance load and the important contribution which the domestic load could make. The average revenue from consumers was still disturbingly low in view of the high costs of supplying new housing schemes. The greatest benefit would obviously be obtained by increasing revenue from existing houses. In that direction the cost and availability of competitive fuels was one factor upon which success depended.

This led to a consideration of matters entering into the sales of appliances—the number of sales staff in each district (for which a formula was developed); the more effective use of demonstrators; the optimum number of service centres; the effect of purchase tax on electric water heaters; and the problem of replacing obsolete hired appliances (particularly cookers), in which the availability of new hire schemes was a pertinent point. The conclusion was drawn that more sales staff and service centres and improved salesmanship were essential.

It was suggested that closer co-operation with electrical contractors might lead to greater sales development. At the same time it was desirable that a Board should provide its consumers with as complete a service as possible. Special mention was made of work carried out on behalf of industrial consumers.

The scope for better lighting, space heating and water heating in commercial premises and shops was stressed and consideration was given to methods of dealing with industrial consumers and the work of power sales staff.

Following a survey of the state of agricultural development in the three Sub-Areas there was a brief note on electric traction, with particular reference to the possibilities of enlarging the trolley-bus load.

The importance of effective and economical after-sales service was stressed and then the authors covered the subjects of consumer records, statistical methods, account collection, etc. In the concluding section the necessity for enthusiasm and belief in electricity on the part of all employees was emphasized.

Consumers' Maintenance Service

The organization of a consumers' repair and maintenance service, with particular reference to the system operated in the author's own area, was outlined by Mr. A. O. Johnson, B.Sc.Tech., A.M.I.E.E. (chief commercial officer, North Western Electricity Board), in a paper submitted on Wednesday morning, when Mr. W. A. Gallon, B.Sc., M.I.E.E., M.Inst. F., presided. He pointed out that in considering the introduction or reorganization of such a service in any locality many factors had to be taken into account and there could be no common pattern for the " ideal " department.

The types of service were classed as minimum (dealing with supply and meter faults, which was obligatory), partial (covering also attention to consumers' equipment where hire or hire-purchase schemes existed) and comprehensive. A comprehensive service should cover most types of electricity consuming apparatus but radio and television repairs were considered to require a separate organization and were not dealt with in the paper. Refrigeration also needed specialized treatment.

Referring to staff organization, the author felt that consumer service of the type described, except in the smallest units, was best operated separately from electrical contracting work, as different management techniques were necessary. The service man must possess qualities over and above competence to tackle repairs efficiently; a tactful approach to a consumer who was not taking proper care of the apparatus might well save the cost of reconditioning.

Consumer satisfaction could only be achieved if the service had the least possible number of complications. One approach might be for periodic inspections of wiring and equipment to be carried out so that breakdown would be rare. This service could be offered at a fixed annual charge, but experience indicated that only a small proportion of consumers would be prepared to meet such a charge. Alternatively, service could be provided without separate charge, and in the North Western Area some steps had been taken in this direction in the repairing of consumers' fuses without charge in emergency. This was kept under review in case of abuse, but seemed to be operating satisfactorily at present. Little extra expenditure was involved, in view of the cost of billing and collecting a small charge.

It might be thought that this facility could be extended and the cost of service concealed in the electricity tariff, but this was

hardly possible at present as it might lead to higher charges and thus reduce development. However, should improved conditions lead to an increase in surplus revenue it might be considered as an alternative to possible tariff reductions.

Industrial Development

On Wednesday afternoon (chairman, Mr. D. H. Kendon, B.Sc., M.I.E.E.) Mr. D. G. Gwyn, B.Sc., A.M.I.E.E. (South Wales Electricity Board) commented on recent development in the industrial field. In 1952 there was a reduction in the rate of growth of industrial utilization, brought about mainly by the trade recession in certain industries, such as textiles and plastics, and shortage of raw materials in others. A graph covering the last thirty years, however, showed that there was a consistent logarithmic growth tendency, and projection of the curve suggested that the industrial use of electricity would double every 9·56 years.

Turning to problems associated with large industrial loads, the author noted that the present integration policy, particularly in the coal and steel industries, was resulting in large amounts of capital being invested in single establishments. A modern colliery with complete coal preparation and by-product plant required up to 10 MW, while an integrated steelworks with high-speed continuous strip mills could establish a 60 MW demand over a 30 min period, with peaks of 75–80 MW. Interruptions of supply therefore resulted in considerable financial loss and occasionally danger to life, so that the minimum of a duplicate supply was required, while in some cases triplicate or even quadruplicate feeders were considered essential.

Delivery of large loads by multi-circuits, often originating from different primary substations, resulted in high fault levels having to be cleared by switchgear under short-circuit conditions. In spite of using high reactance transformers to step down the supply to their works distribution voltages, consumers' engineers were finding that their distribution layouts were being increasingly conditioned by the costs of clearing high short-circuit power. Mention was made of a case where a consumer who required a 3·3 kV automatic ring main system was obliged to adopt a radial system with interlocked interconnectors between his unit substations because the highest flameproof certificated switchgear obtainable was for 25 MVA at 3·3 kV.

Dealing with power factor, Mr. Gwyn pointed out that while continuous unit p.f. would appear to be the ideal economic condition it was not always technically advisable. During the negotiation stages of a 35 kVA load recently commissioned, it was found that a neighbouring base-load power station would be adversely affected if the consumer's p.f. exceeded 0·95 lagging.

Aspects of the large new steelworks at Margam and Trostre were cited as an indication of modern technique and tendencies; mention was made of the large lighting load and the extensive use of pumpless steel tank mercury arc rectifiers. Quarry applications provided a good example of the way in which productivity could be increased by electrification. In conclusion mention was made of the great advances in recent years in control equipment.

Value of Display

The aspects of display as applying to the electricity supply industry formed the subject of a paper on "Electricity on Display," on Thursday (yesterday) morning, by Mr. N. F. Phillips (E.D.A.), when the chairman was Mr. W. R. T. Skinner, B.Sc., A.K.C., M.I.Mech.E., M.I.E.E. He gave a broad outline of the selling effort that should be sought from the various forms of display. Posters should convey and fix an identity, and not more than one selling feature. Exhibitions should convey and fix an identity, conveying, preferably by practical demonstration, sufficient of the selling features to incite inquiry of attendant staff. As many selling points as possible should be conveyed by salesrooms, bearing in mind that visits were normally repetitive and often regular.

Window displays should convey one selling feature at a time, create a desire for more information, encourage entry into the salesroom and an habitual interest in the windows. For electricity supply, display should be used to sell confidence in the undertaking, goodwill, tariffs with hire terms, mode of usage, such as limitation of maximum demand, services, and appliances and their applications.

The author dealt with the planning of displays for windows and showrooms and exhibition demonstrations, the packing and dispatch of display material and the production of display material. Although it might

be necessary to buy outside rather than set up a display production workshop, he recommended that the display design unit, as opposed to the construction unit, should be internal.

Mr. Phillips concluded his paper by summarizing the right and wrong methods of approach to display. The paper was illustrated by pictures of showroom displays and layout diagrams with examples of exhibition stands and a display production unit.

Farm Electrification

Mr. J. Mould, A.M.I.E.E., presided in the afternoon when, in a paper on " Farm Electrification," Mr. C. A. Cameron Brown, B.Sc., M.I.E.E. (agricultural electrification adviser, B.E.A.), reviewed the present position. He said that agricultural emphasis was laid time and time again on the possibility of upgrading our production. This required a universal upgrading of our high-farming technique to the level of at present the comparatively few pace-makers.

To get much further in technical farming progress the individuals concerned had need of some basic morale builder, such as modern amenities in the home through electricity and farm electrification. A " national " return of 4,700 kWh per farm hardly indicated reasonable domestic electrification much less a wide use of electricity in the many ways in which it could help the farmer.

At an average cost per kWh used on farms of 1·339d this meant only £27 5s per farm, which justified a supply outlay per farm connection of under £140, a poor outlook for any hope of economic connection of the 100,000 or more farms yet to be connected by the Area Boards. This average figure was far below the potential figure of consumption and revenue per farm.

The crux of the whole matter was the question of complete and comprehensive sales and advice to the farm consumer. " High-electrification " was unlikely without high sales and services by the Electricity Boards at all levels. The gain achieved by an intensive agricultural sales policy was not to be judged entirely by profits on the operation of equipment sales only. Board sales were likely to bring Board wiring, higher consumption of electricity and good consumer relations, and above all they could bring a better type of load.

Turning to the technical side, Mr. Cameron Brown said that, while in farm connections we stood but poorly in the ranking list of developed countries, we had nothing to be ashamed of in regard to our depth of penetration and technical development. There would appear to be nothing elsewhere to match our widespread developments in farm steam-raising or our all-electric grain drying. Nor had any country, with the possible exception of the United States, applied the automatic low-powered hammer-mill so widely as we had in this country.

He covered the technical developments in milk cooling, crop drying, barn hay drying, poultry farming and horticulture. The greatest cause for unease, he said, was the steadily increasing price of equipment, and he wondered whether some such device as the pre-vesting bulk-purchase organization might be worth considering.

Yesterday (Thursday) afternoon a visit was arranged to the Royal Festival Hall for a demonstration of the electronic organ and colour-change effects and in the evening there was a visit to the Lighting Service Bureau. There the delegates were shown Coronation decorations and Mr. H. S. Hind, A.M.I.E.E., lectured on " The Presentation of 16 mm Films."

To-day (Friday) morning there is to be a general discussion at the Café Royal, under the chairmanship of Mr. V. W. Dale, general manager of E.D.A., and Mr. H. Nimmo, M.I.E.E., M.I.Mech.E., chairman of the Association, will preside at a luncheon to follow.

Illumination Terms

THE glossary of terms used in illumination and photometry, which has recently been published by the British Standards Institution as B.S.233: 1953, is a revision and extension of sub-section 81 of the glossary of terms used in electrical engineering (B.S.205). Copies are obtainable from the B.S.I., 24, Victoria Street, London, S.W.1, price 3s 6d.

Many of the definitions and terms included are in agreement with those adopted by the International Commission on Illumination and some of the quantities defined are based on the properties of the " Standard Observer " agreed by the Commission.

The foreword points out that while purporting to give the generally accepted meaning of a term, the definition thereof must not be regarded as in any way taking the place of the specification. An alphabetical index is included.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Small Mixer

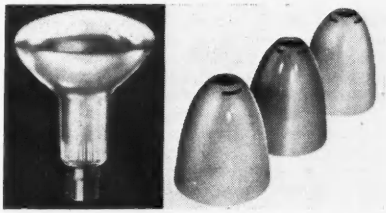
THE demand for a small domestic mixer has been met by the introduction of a new machine by KENWOOD ELECTRICS, LTD., 151, Oxford Street, London, W.1. With a white plastic body and black handle, it is of light weight and is designed for hanging on a wall bracket. A switch is incorporated in the handle. Two stainless steel beaters are normally attached, but the use of only one permits the mixing of drinks, etc., in small utensils such as glasses. The price is £7 5s (plus £2 13s purchase tax). For the export market the apparatus is available complete with stand, bowl, etc.

Modern Lampshades

To meet the demands of owners of lighting fittings who wish to fit shades of contemporary design BATTENBERG & CO., LTD., 6, Great Winchester Street, London, E.C.2, have produced a range of stove enamelled aluminium reflector shades in six colours: signal red, canary yellow, willow green, cream, grey and white. They sell at 6s 9d each.

Reflector Spotlight

The new "Mazda" 75 W reflector spotlight made by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2, fits an ordinary domestic lampholder, and has an internal parabolic type reflector set in a frosted crown. The result is a powerful beam of controlled light which is extremely useful for close work. Although the standard lamp is fitted with a bayonet cap, it can also be obtained with an e.s. cap. The reflector spotlights are priced at 8s plus purchase tax in the United Kingdom.



"Mazda" 75 W reflector spotlight and Battenberg & Co.'s contemporary lamp shades

Coronation Plaque

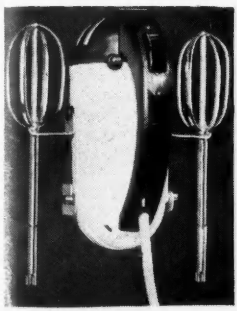
A plaque with a relief portrait of the Queen within a decorative circle studded with coloured lamps is being supplied by G. S. PECKHAM & CO., LTD., 3, 4 and 5, New Compton Street, London, W.C.2. The list price is 5 guineas.

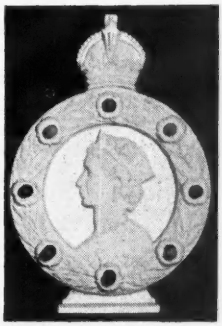
Convection Heater

The latest addition to the range of heating appliances manufactured by CARTER & CO. (NELSON), LTD., William Street, Nelson, is a convector supplied either as a separate unit or complete with tiled surround. It can be inserted into new or existing fireplaces, fitting flush with the wall. No floor space is required. The elements, which are described as indestructible, are completely out of reach of clothing or fingers, rendering the unit particularly suitable for the kitchen, playroom, bedroom, etc.

Available at present in ¾ kW or 1 kW loadings and with chrome, vitreous enamel and other attractive finishes, the convector is fixed by only four screws, a feature that will appeal to the installation contractor. The lowest priced model, a cast aluminium unit, costs £6 10s 6d (£3 14s 1½d P.T.). A similar model in chrome is £10 12s 6d (£6 2s P.T.). It is hoped to have larger versions available soon with loadings of 2 kW and 3 kW.

Left: **Small Kenwood mixer.** *Right:* **Peckham's "A.1" Coronation plaque**





Financial Section

STOCKS and SHARES

INVESTMENT remains in cautious mood, with much of the available business gravitating towards the comparative safety of the gilt-edged market, and leaving dull conditions in most other sections of the Stock Exchange. Industrial markets have found food for thought in the annual dividend and profits statements issued by a group of our greater enterprises. Common to several of their experiences in 1952 was a sizeable drop in trading profits, offset largely by correspondingly smaller tax provisions, leaving the companies with little difficulty in maintaining previous rates of dividends, and the Exchequer the chief loser in the process. The net impression left on markets can be said to be sobering rather than dispiriting.

Henley's Dividend

Allowing for the free share-for-share bonus distributed at the end of last year, the final dividend of 8 per cent now declared by W. T. Henley's Telegraph Works makes a total equivalent to 10½ per cent for the year on the present capital, or a fraction more than the previous rate. It goes, however, to capital increased by more than 800,000 shares issued for cash since the last period. The payment was up to market expectations, but the response was tempered by the accompanying statement, showing some reduction in the net group profit. This is attributed to the loss sustained by a subsidiary, for the parent company's earnings have again expanded. The shares stand now on a yield basis of approximately £5 11s per cent.

Southern Areas

Southern Areas £1 shares were marked up on the company's decision to pay a 1 per cent bonus in addition to maintaining the dividend at last year's rate of 5 per cent. After changing hands previously down to 10s 6d, dealings in the shares were recorded afterwards up to 13s. Good earnings figures supported the decision, the net group profit of £82,500 being nearly two-and-a-half times the previous figure, despite much larger provisions for taxes and depreciation. The dividend costs less than £26,000 net, leaving £56,000 to go back into the business.

Automatic Telephone Results

With profits for 1952 below the previous year's, the Automatic Telephone and Electric Company is keeping unchanged the 15 per cent rate of ordinary dividend paid on the two previous occasions: it was raised from 12½ per cent in 1950. Dividends for the year apply this time to capital increased by the issue of 544,000 ordinary shares at 45s last February. They absorb altogether a net sum of £184,000 out of group surplus earnings of £540,000, which go against the 1951 taxed profit of £711,000. Although quoted lower at 58s 9d, the £1 ordinary shares continue to afford the relatively modest yield of £5 2s 3d per cent, which marks them as a highly respected security.

Recent Issues

Bakelite new 5 per cent debentures 1968 77 (now £25 paid) retain a premium of about 2½ points on the issue price of 100. The success of this £1 million issue, and of other similar offers, testifies to the increased partiality which investment has acquired for first-rate securities of this type, giving a living rate of interest from a fixed rate of dividend and providing for repayment of the capital over some definite term. The new British Electricity 4¼ per cent "A" stock remains about par. Johnson & Phillips new ordinary are quoted at a premium of 21s on the price of 30s, at which they are offered to existing stockholders.

British Thermostat

An increase in the British Thermostat Company's dividend had been confidently anticipated, so that the 5 per cent increase in the final dividend, bringing the total for the year to 35 per cent, made little impression on the shares. They remained quoted at 31s 3d, which makes the yield on the new rate of dividend about 5·6 per cent. The net profit shows a useful increase to £150,000, which exceeds, nearly five times over, the amounts paid out in dividends, and consequently leaves the latter in the highly conservative class. Earlier, the company had announced its intention to distribute a share bonus and also to raise fresh capital by the issue of shares for cash.

Price Changes

Aberdare Cables 5s shares were marked up to 16s on the company's announcement that application has been made for the distribution of a 100 per cent share bonus. Tube Inves-

ments came back to 57s on the declaration of an ordinary interim dividend of 7½ per cent. Babcocks have fallen further to 64s ex dividend, and others which lost ground during the week included Hoovers, Lancashire Dynamo, Lucas and Murex. On the other hand, better prices were quoted for Decca, E.M.I., Hackbridge & Hewittic, Thorn Electric, and Cable & Wireless. Telephone Properties continued to jump round about £5, and the spectacular feature elsewhere was a rise of 17s to 45s in Bagdad Light & Power, on acquisition talk.

Company	Dividend Previous	Dividend Last	Middle Price 11th May 1953	Week's Rise or Fall	Est. Yield p.c. £	s	d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	88	—	3	8	2
Brit. Elec. 1974/77	3	3	86½	—	3	9	4
Brit. Elec. 1976/79	3½	3½	91½	−½	3	16	6
Brit. Elec. 1974/79	4½	4½	100½	—	4	4	6
Calcutta Elec. ..	6†	6†	20/6	—	5	17	0†
East African Power	7	7	22/-	−1	6	7	3
Nigerian Elec. ..	10	10	22/6	—	8	18	0
Palestine Elec. "A"	5†	Nil	13/6	—		—	
Perak Hydro-Elec.	Nil	Nil	15/-	—		Nil	
Equipment and Manufacturing							
AberdareCables(5/-)	20	25	16/-	+6d	7	16	4
Aerialite (1/-) ..	83½	88½	9/3xd	—	9	11	0
Allen, W. H. ..	15	15	46/3	—		—	
Aron Elec. Ord. ..	15	15	38/9	—	7	14	10
Assoc. Elec. Ord...	20	20	80/-	—	5	0	0
Automatic Tel. & El.	15	15	58/9	−⅜	5	2	3
Babcock & Wilcox	18	18	64/-xd	−2/6	5	12	6
Baldwin, H. J.(2/-)	25	20	4/-	—	10	0	0
Bakelite (10/-) ..	—	12½	17/-	—	7	7	0
British Aluminium	12	12	39/-	—	6	3	0
B.I. Callender's ..	9	10	36/6xd	−3d	5	9	7
British Thermostat (5/-)	30	35	31/3	—	4	16	0
British Vac. Cleaner (5/-)	25	25	13/9	−3d	9	1	9
Brook Motors (10/-)	20	20	33/9	—	5	18	6
Brush Ord. (5/-) ..	10	4	3/9	−6d		—	
A. F. Bulgin (1/-)..	30	30	2/9	—	10	18	0
Burco (5/-) ..	38¾	35	17/6xd	−1/-	10	0	0
Chloride El. Storage	15	20	69/-	—	5	16	0
Cole, E. K. (5/-) ..	25	25*	17/-	—		—	
Cossor, A.C. (5/-)..	Nil	10	9/6	—	5	5	3
Crabtree (10/-) ..	17½	17½	31/-	—	5	13	0
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	9/9	—	5	15	5
De La Rue (5/-) ..	50	35*	7/6	—		—	
Decca (5/-) ..	112½	150	25/6	+6d	5	17	9*
Dewhurst (2/-) ..	22½	19*	5/6	—	6	18	3
Dictograph Tel. (2/-)	20	20	6/6	—	6	3	0
E.M.I. (10/-) ..	12	12	13/3	+3d	9	1	2
Electrical Components (5/-) ..	20	20	10/-	—	10	0	0
Elec. Construction	15	15	55/-	—	5	9	0
Enfield Cable Ord.	7½	5	21/6	—	4	13	0
English Electric ..	15	15	58/-	—	5	3	6
Ericsson Tel. (5/-)	22†	22*†	39/-	−1/-	2	16	5
Ever Ready (5/-)	35	35	27/6xd	−6d	6	7	3
Falk Stadelmann..	15	15	42/3	−1/-	7	2	0
G.E.C. Ord. ..	22½	22½	41/3	—	5	9	1*
General Cables (5/-)	30	30	16/3	—	9	4	6
Greenwood & Batley	15	15	40/-	—	7	10	0
Hackbridge Cable (5/-)	20	20	12/-	—	8	6	8
Hackbridge Hewittic (5/-)	18	20	17/-	+9d	5	17	8
Hall Tel. Acc. (10/-)	10	10	11/3xd	—	8	17	10
Hartree (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (10/-) ..	20	20	18/-	−1/-	5	11	1†
Hellophane (5/-) ..	15	20*	12/6	—	8	0	0
Hoover (5/-) ..	35	25	21/9	−⅛	5	15	0
Equipment and Manufacturing (continued)							
Intl. Combustion (5/-)	25	15*	14/3	—	5	5	3
Johnson & Phillips	15	15	49/9xd	−6d	6	0	6
Lancashire Dynamo	12½	12½*	43/9xd	−1/9	5	14	3
Laurence, Scott (5/-)	15	15	14/3	—	5	5	3
London Elec. Wire	12½	12½	58/9	+⅛	4	5	0
J. Lucas	7½	9⅛	38/9	−⅛	4	14	7
Marryat & S. (2/-)	22½	22½	5/9	—	7	16	6
Mather & Platt ..	12½	15	49/6	—	6	1	3
Metal Industries ..	10	15	43/3	−3d		—	
Mid. Elec. Mfg. ..	15	15	60/9	—	4	18	9
Murex	12½	15	58/9	−⅛	5	2	3
Newman Ind. (2/-)	10	10	2/3	−1½d	8	17	9
Oldham & Son (1/-)	30	35	2/6	—		—	
Parnall (Yate) (5/-)	6	6	2/9	−6d	10	18	3
Parsons, C. A. ..	10*	12½	67/-xd	−1/-	3	14	9
Plessey (5/-) ..	22½	25	23/6	—	5	6	3
Pye Deferred (5/-)	18	18	18/9	−9d	4	16	0
Revo (10/-) ..	27½	27½	46/-	—	5	19	7
Reyrolle	10*	12½	56/3	—	4	8	8
Scot. Cable (4/-) ..	30	32	12/9	—		—	
Siemens Ord. ..	10	10	35/6	—	5	12	9
Southern Areas ..	5	6	12/6	−3d	9	12	0
Strand Elec.(5/-)..	17½	17½	10/-	—	8	15	0
Sturtevant (5/-) ..	17¼†	18·1*†	23/9xd	−9d	3	16	3†
Switchgear&Cowans (5/-)	22½	22½	14/9	—	7	12	7
Taylor T. (5/-) ..	20	25	20/-	—	6	5	0
T.C.C. (10/-) ..	20	20*	41/3	—	4	17	0
T.C. & M. ..	10	8½*	28/-	—	6	1	6
Telephone Mfg.(5/-)	10	10	8/9	—	5	14	3
Thorn. Elec. (5/-)..	10	12½	10/9	+9d	5	16	4
Tube Investments	25	15*	57/-	−3/-	5	5	3
Vactric (5/-) ..	Nil	Nil	5/-	—		Nil	
Veritys (5/-) ..	7½	10	5/-	—	10	0	0
Walsall Conduits (4/-)	70	70	46/-	—		—	
Ward & Goldstone (5/-)	45	45*	35/-	—		—	
Watford (2/-) ..	25	25	6/9xd	—	7	8	3
Westinghouse Brake	14	15	53/9	—	5	11	6
West, Allen (5/-)..	15	15	12/6	—	6	0	0
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord.	—	6	89½xd	+1½	6	14	0
Ord.	—	3⅜	57½xd	+4	6	10	5
Anglo-Portuguese	8	8	22/3xd	—	7	3	8
Brit. Elec. Traction: Def. Ord. ..	22½	25	520	—	4	15	9
Cable & Wireless: Ord.	8	8	136	+2	5	17	9
4% Loan ..	4	4	95	—	4	4	3
Calcutta Trams ..	6†	6†	22/3xd	—	5	7	9†
Cape Elec. Trams..	5	5½	11/6	—	9	11	4
Marconi Marine ..	10	10	30/-	−6d	6	13	4
Oriental Tel. Ord.	16	16	67/6	−4/6		—	
Telephone Props...	8	8	100/-	—		—	
Tele. Rentals (5/-)	10	10	8/6xb	—		—	

* After capital bonus. † Dividends are paid free of Income Tax.

REPORTS and DIVIDENDS

C. A. Parsons & Co., Ltd.—The annual meeting will be held on 27th May. In his circulated statement, Sir Claude D. Gibb (chairman and managing director) says that the production of turbo-generators and transformers reached new record levels during the year and in the two years 1951 and 1952 Parsons commissioned throughout the world over 2,000,000 kW of turbo-generators and in both years made the biggest contribution to new generating plant for the British Electricity Authority. The third 100,000 kW turbo-alternator for the Richard L. Hearn generating station of the Ontario Hydro-Electric Commission was put into service in the record time of two years from the date of order, while the fourth unit of similar output is now being erected in Toronto. Plant has been supplied during the year to Australia, Canada, Holland, India, Malaya, Mexico, Rhodesia, South Africa and Venezuela. The recently created pipework division has completed the fabrication of almost 600,000 kW of plant pipework in one year.

Orders both for home and overseas during 1952 were at a satisfactory level, but there are signs of stiffening competition in overseas markets, and it is necessary to avoid further increases in manufacturing costs. Financial restrictions in many export markets have caused important power station extensions to be deferred, necessitating considerable re-planning of their production schedules. A small works is to be established at Whyalla, in South Australia, to manufacture condensing and feed-heating equipment for installation and operation in conjunction with steam turbo-generators manufactured at the Heaton works and shipped to Australia. A wholly-owned subsidiary under the title of C. A. Parsons of Australia, Ltd., is to be formed to operate the new factory.

Babcock & Wilcox, Ltd.—In his statement which has been circulated with the report and accounts for 1952, Mr. W. L. Fraser (chairman) says that the past year has been a trying one, not the least of their problems being those caused by shortage in the supplies of steel and other components required for their manufacturing processes. It was not until the latter months of the year that some signs of slow improvement were noticeable. Even then there was no appreciable betterment in the deliveries of certain types and qualities of steel, the lack of which still gives rise to anxiety. In the circumstances the turnover and trading profit are satisfactory. Looking to future developments, there can be little doubt that the efficient utilization of coal and other fuels will remain the predominant factor in steam generation, and research and development in combustion, as well as in all other methods by which power can be produced, continue to hold a prior place in the attention of the company.

Contracts for export surpassed in value those gained in any previous year. This was accomplished in spite of keener world competition. Referring to the company's overseas interests, Mr. Fraser says that they have decided to commence manufacturing in both Brazil and Mexico. Additional plant has been commissioned in the works of Babcock & Wilcox of Australia Pty., Ltd., and there has been a big improvement in output during the past year. The first section of the works at Vereeniging is now in operation and the volume of orders already secured in South Africa should provide a sufficient load for this new manufacturing unit for some considerable time ahead. In Japan they had concluded an arrangement with Hitachi, Ltd., which unites Japanese interests with their company for the further development of business in Japanese territories.

The British Thermostat Co., Ltd., shows a group profit attributable to the parent company for the year to 31st January last of £150,097, as compared with £116,953 for 1951-52, after deducting £152,668 for taxation and £23,696 for depreciation. General reserve receives £90,014, and it is proposed to pay a final ordinary dividend of 27½ per cent, making 35 per cent for the year (against 30 per cent). The balance carried forward is £309,072 (against £273,955 brought in).

The Atlas Electric & General Trust, Ltd., reports that, subject to audit, the net revenue for the year ended 31st March last, after all charges, including £323,029 for taxation, is £306,429, as compared with £279,918 for the preceding year. General reserve receives £100,000 and it is proposed to pay an ordinary dividend for the year of 6 per cent (against 5 per cent). The balance carried forward is £246,387 (against £243,151 brought in).

Ozonair, Ltd., reports that after providing £8,775 for taxation, the net balance for 1952 is £2,128, as compared with £3,639 for 1951. It is proposed to pay an ordinary dividend of 8⅓ per cent for the year (same on smaller capital and 4 1/6 per cent on new capital), plus a bonus of 1⅔ per cent (nil). The carry-forward is £4,219 (against £3,466 brought in).

The Southern Areas Electric Corporation, Ltd., reports consolidated profits for 1952 of £220,534, against £116,333 for the previous year, and a net balance, after deducting taxation of £129,882 and minority interests of £8,192, of £82,460 (against £34,167). The dividend for the year is

unchanged at 5 per cent, but in addition a bonus of 1 per cent is paid. After placing £40,000 to contingencies, the carry-forward is £127,926 (against £111,321 brought in).

W. T. Henley's Telegraph Works Co., Ltd. reports a group profit for 1952, subject to audit, after providing £573,244 for taxation, of £522,398, as compared with £646,447 for 1951. The profit of the parent company is £594,554 (against £534,163), the reduction in the group net profit being due to a loss sustained by a subsidiary company. Reserves receive £280,000 and it is proposed to pay a final dividend of 8 per cent on increased capital of £4,875,000 ordinary stock, which with the interim dividend paid on £2,437,500 is equivalent to 10½ per cent on the present ordinary capital. For the previous year the dividend was 15 per cent, plus a bonus of 5 per cent on £1,625,000 ordinary stock. The balance carried forward is £879,588 (against £924,574 brought in).

The Automatic Telephone & Electric Co., Ltd., reports a group profit for 1952 of £1,137,917, as compared with £1,545,399 for the preceding year, and after deducting £599,154 for taxation, the net profit is £538,763 (against £711,350). After making various allocations, it is proposed to pay a further dividend of 12 per cent, making 15 per cent for the year (same), on increased capital. The balance carried forward is £490,932 (against £451,659 brought in).

Tube Investments, Ltd., announces an interim ordinary dividend of 7½ per cent (against 13½ per cent prior to 100 per cent scrip issue).

Radio Rentals, Ltd., has declared an interim ordinary dividend of 10 per cent (same) on increased capital.

New Companies

Gilmoor-Vuille Remote Control Systems, Ltd.—Registered 15th April. Capital £2,000. Manufacturers of and dealers in all forms of remote indicating and control systems and equipment, electrical, mechanical and general engineers, etc. Joint managing directors: A. Gilmoor, 143, Uxbridge Road, Rickmansworth, Herts. and B. A. Vuille, 6, Hyde Road, Watford, Herts.

Energy Batteries (Birmingham), Ltd.—Registered 1st April. Capital £5,001. Directors: J. McGrath, Mrs. Annie K. Ritchie, J. Allison and Mrs. Barbara M. Grant. Regd. office: Manor Works, Spring Hill, Halesowen.

Metal Detection, Ltd.—Registered 1st April. Capital £100. Manufacturers of and dealers in machines, equipment and devices for electronic detection and/or location of metals in processed materials and non-metallic objects, etc. Directors: F. C. Heath and F. D. Clough. Regd. office: 71, Edmund Street, Birmingham.

A. E. Horder & Co., Ltd.—Registered 23rd April. Capital £1,000. Electrical engineers and general electrical installation contractors, lighting specialists and contractors, wireless and television engineers, etc. Directors: W. T. Townsend (permanent managing director) and Mrs. E. M. Townsend. Secretary: W. T. Townsend. Regd. office: 515, Fishponds Road, Bristol.

Liquidations

Patterson Lamps, Ltd., miner's safety lamp manufacturers.—Winding up as a members' voluntary winding-up in accordance with the provisions of section 283 (4) of the Companies Act, 1948. Liquidator, Mr. J. Hutchinson, 1, St. Nicholas Buildings, Newcastle-on-Tyne, appointed 24th April.

Mayor Smith, Ltd., refrigeration electrical engineers.—Winding up voluntarily. Liquidator, Mr. S. O. Henry, 5, Rumford Place, Liverpool, 3, appointed 1st May.

Great Asby Electric Light & Water Co., Ltd. (members' voluntary winding-up).—Particulars of claims to be sent to the liquidator, Mr. A. D. Compston, North Western Electricity Board Headquarters, Cheetwood Road, Manchester, 8, by 26th May. (This notice is formal and all known creditors have been or will be paid in full.) A general meeting of members is to be held at the same address on 22nd June to hear an account of the winding-up from the liquidator.

Wembley Electrical Appliances, Ltd., Exhibition Grounds, Wembley.—Proofs for dividends by 23rd May, to the liquidator, Mr. E. T. Wood, 7/8, Chandos Street, London, W.1.

Bankruptcies

A. J. Digby, 238, Walworth Road, London, S.E.17, and at 22f, Doughty Mews, W.C.1, electrical engineer.—Receiving order made 1st May on debtor's own petition.

L. Peel, of, and lately carrying on business at, 216, Low Lane, Horsforth, near Leeds, electrical engineer.—Receiving order made 28th April on a creditor's petition. First meeting held 14th May. Public examination 21st July at the County Court House, Albion Place, Leeds.

H. F. Thorrington, Eydon, Northants, electrical contractor.—First meeting held 13th May. Public examination 12th June at the Town Hall, Banbury.

J. S. Anderson, radio and electrical engineer, trading as "Electronic Services," Nearavon, Salisbury Street, Fordingbridge, Hants.—Second and final dividend of 2¼d in the £, payable 18th May at the office of the trustee.

New Books

Electrical Measurements. Part II. By D. Karo. Pp. 343; figs. 281. Macdonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 30s.

This book is intended to serve as a textbook for students preparing for the B.Sc. (Eng.) examination in electrical measurements, and also as a reference book for use in the measurements laboratory.

The opening chapters deal with the classical methods of solving circuits having lumped or distributed constants, followed by a summary of the properties of laboratory standard resistors, inductors (self and mutual) and capacitors.

A detailed account is then given of the theory of operation of the auxiliary apparatus required in the measurements laboratory, i.e., vibration galvanometers, telephones and the cathode ray oscilloscope.

The general properties of a.c. bridges are then discussed, including the problems of shielding and the elimination of stray impedances by means of the Wagner earth. The remainder of the book deals with bridges for the measurement of R, L, C and f, and the use of the a.c. potentiometer and twin T circuits.

The author has rightly stressed the importance of assessing the accuracy of a bridge measurement, but has not adequately dealt with the methods of determining the existence and magnitude of sources of error in the network itself, such as inductive coupling between components and wiring, and direct coupling between the signal source and detector, intermodulation errors, etc. In the writer's opinion, the theoretical treatment of several aspects of the subject could be greatly simplified without loss of vigour, and a more detailed index would increase the value of the book.—H.B.W.

Electronic Measurements. By F. E. Terman and J. M. Petitt. Second edition. Pp. 707; figs. and index. McGraw-Hill Publishing Co., Ltd., Aldwych House, London, W.C.2. Price 72s 6d in the United Kingdom.

The present book is a completely revised and greatly enlarged version of Terman's "Measurements in Radio Engineering" which was first published in 1935. The text covers a very wide field, and summarizes the theory and technique of measurements on components and circuits from power to micro-wave frequencies.

In addition to the more or less well-known methods of measuring voltage, current, power, frequency, etc., much of the book is devoted to apparatus and techniques which were either developed or assumed great importance during the war. Thus measurements on micro-wave propagation, wave guides, circuit noise and aerials are discussed at some length and a very useful chapter is also included on waveform generation.

The extensive bibliography, which contains approximately 1,000 references, is indicative of both the range of subjects covered and the diligence of the authors. It is also a useful feature of the book that although it is an American publication, many of the original papers cited are of British origin.

As one would expect from a work with which Terman is associated, the book is well written and carefully indexed, thus facilitating the rapid extraction of information. It is confidently anticipated that this book will be in constant demand both by the radio engineering student and the practising engineer.—H.B.W.

Books Received

Generation, Transmission and Utilization of Electrical Power. By A. T. Starr, M.A., Ph.D., M.I.E.E. Third edition. Pp. 517; figs. 432; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 20s.

The Induction Motor. By H. Vickers. Pp. 531; figs. and index. Sir Isaac Pitman & Sons, Ltd. Price 70s.

Radio Engineering. By E. K. Sandeman, Ph.D., A.C.G.I., M.I.E.E. Second edition. Pp. 613; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 55s.

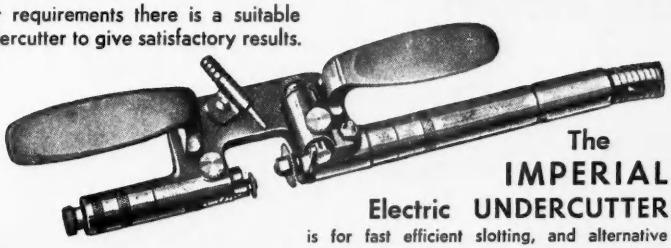
Electromagnetics. By John D. Kraus. Pp. 538; figs. and index. McGraw-Hill Publishing Co., Ltd. Price 76s 6d in the United Kingdom.

Modulators and Frequency Changers. By D. G. Tucker. Pp. 232; figs. 115; index. Macdonald & Co. (Publishers). Price 21s.

Television Receiver Design. I. By A. G. W. Uitjens. Pp. 177; figs. 123; index. Philips Technical Library. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 21s.

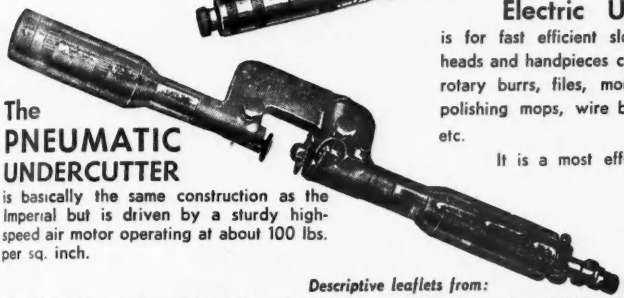
MARTINDALE MICA UNDERCUTTERS

Whatever your requirements there is a suitable Martindale Undercutter to give satisfactory results.



The
IMPERIAL
Electric UNDERCUTTER
is for fast efficient slotting, and alternative heads and handpieces can be used for driving rotary burrs, files, mounted grinding points, polishing mops, wire brushes, sanding discs, etc.

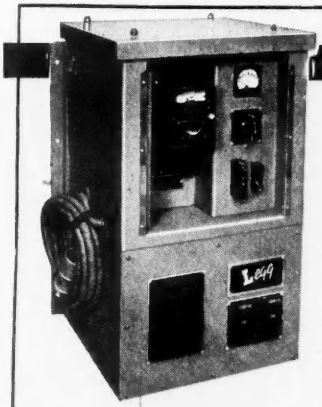
It is a most efficient electric machine for both portable and shop use for commutators 6" diameter and upwards.



The
PNEUMATIC
UNDERCUTTER
is basically the same construction as the Imperial but is driven by a sturdy high-speed air motor operating at about 100 lbs. per sq. inch.

Descriptive leaflets from:

MARTINDALE ELECTRIC CO. LTD., 4 Westmorland Road, London, N.W.9



LEGG INDUSTRIES LIMITED

Legg Industries Limited design and manufacture Charging Equipment for Electric Vehicles and Trucks of all types, and the majority of leading manufacturers specify LEGG CHARGERS for use with their equipment—both at Home and Abroad.

WHEN YOU PURCHASE A LEGG CHARGER YOU ENSURE YEARS OF RELIABLE SERVICE

Chargers are also designed and manufactured to comply with C.S.A. requirements.

Legg **VEHICLE CHARGERS**

LEGG (INDUSTRIES) LTD.
WILLIAMSON ST., WOLVERHAMPTON 5723A

FROM STOCK UP TO 40 H.P.

Crofts "RADIATION" WORM REDUCTION GEARS

● **STOCK RATIOS**

5–1, 7½–1, 10–1, 12½–1, 15–1, 20–1
25–1, 30–1, 40–1, 50–1, 60–1.

● **WRITE FOR BROCHURE 521/. 9 FOR QUICK & EASY SELECTION OF OUR STOCK UNITS.**

DELIVERY TIMES THAT CAN'T BE BETTERED!

Phone BRADFORD 65251 EXT. 555 OR WRITE

Crofts CROFTS (ENGINEERS) LTD., BRADFORD

PHONE: 65251 (15 LINES) GRAMS: "CROFTERS BRADFORD

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 24th June from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

7787. Brush Development Co., and Lynch, T. E.—Electro-mechanical transducer units. 17th February, 1948. (693161.)

1948

15187. Duuren, H. C. A. Van.—Two-way type-printing telegraph systems. 8th June, 1949. (693211.)

1949

24812. Standard Telephones & Cables, Ltd.—Electric signalling systems. 22nd September, 1950. (693165.)

1950

4120. English Electric Co., Ltd.—Inductive apparatus such as power transformers. 14th February, 1951. (693037.)

4669. West & Co., Ltd., A., and Mathews, H. H.—Electric circuit controllers comprising cam-operated switches. 30th March, 1951. (693169.)

4891. Electric & Musical Industries, Ltd.—Circuits for setting the level of electric signals. 7th February, 1951. (693220.)

5248. Electric & Musical Industries, Ltd.—Manufacture of optical windows for the envelopes of electron discharge devices especially cathode-ray tubes. 28th February, 1951. (693285.)

9335. Garrard Engineering & Manufacturing Co., Ltd. Mortimer, E. W., and Tovey, A.—Recording and reproducing apparatus for radio receivers. 20th March, 1951. (693039.)

11051. British Thomson-Houston Co., Ltd. (General Electric Co.).—Electric induction apparatus. 4th May, 1950. (693288.)

11515. Battelle Development Corporation.—Electrophotographic plate and method of producing same. 9th May, 1950. (693112.)

15950. Fortiphone, Ltd.—Telephones. 12th June, 1951. (693290.)

16090. Folger, J.—Electrically heated liquid heating device. 28th June, 1951. Cognate application 15327, 28th June, 1951. (693291.)

17568. General Electric Co., Ltd., and Lambert, R. A.—Electric switching arrangements. 9th May, 1951. Cognate application 25515. 19th October, 1950. (693042.)

19611. Elliott Bros. (London), Ltd.—Electrical pulse handling circuits. 3rd August, 1951. (693116.)

19965. Siemens-Schuckertwerke Akt.-Ges.—Means for catching fish by electricity. 10th August, 1950. (693229.)

20537. General Electric Co., Ltd., and Dale, S. H.—Circuit arrangements for detecting reverse current in vapour arc convertors. 6th December, 1951. (693177.)

22332. Lockwood, L. P.—Distribution switch and/or fuse units. 28th June, 1951. (693299.)

22418. Philips Electrical Industries, Ltd.—V-shaped electric lamp, discharge tube and like filaments. 12th September, 1950. (693119.)

22446. Metropolitan-Vickers Electrical Co., Ltd.—Servo systems. 16th August, 1951. (693181.)

22430. Philips Electrical Industries, Ltd.—Transistors. 25th September, 1950. (693120.)

22756. Allen, Sons & Co., Ltd., W. H., and Oxford, J. T. B.—Method and apparatus for heating air or working fluid by waste gases for gas turbine cycles. 23rd July, 1951. (693182.)

25616. English Electric Co., Ltd.—Electronic computing apparatus. 21st December, 1951. (693122.)

26731. Lucas, Ltd., J.—Vehicle electric lamps. 19th October, 1951. (693233.)

26947. Marconi's Wireless Telegraph Co., Ltd.—Frequency-shift telegraph receivers. 6th July, 1951. (693049.)

28822. Midgley, A. H.—Synchronous motors. 21st November, 1951. (693305.)

29227. British Dielectric Research, Ltd.—Electrolytic capacitors. 28th November, 1951. (693050.)

29503. Akt.-Ges. Brown, Boveri & Cie.—Magnetic induction accelerator. 1st December, 1950. (693307.)

30736. Ferranti, Ltd.—Synchronization of electric timebase circuits. 17th December, 1951. (693309.)

30779. British Thomson-Houston Co., Ltd.—Electric discharge devices. 18th December, 1950. (693052.)

1951

725. Ricardo & Co., Engineers (1927), Ltd., and Hempson, J. G. G.—Rotors for magnetos. 21st November, 1951. (693056.)

998. Dunlop Rubber Co., Ltd.—Electric battery cases. 4th December, 1951. (693191.)

1070. Pittsburgh Plate Glass Co.—Electro-conductive coating on a refractory base and process for the manufacture thereof. 15th January, 1951. (693127.)

1536. Hobson, Ltd., H. M., and Smith, C. P.—Apparatus for driving and synchronizing parallel-connected alternators. 24th October, 1951. (693057.)

3201. Western Electric Co., Inc.—Electrical translating devices utilizing semi-conductive bodies. 9th February, 1951. (693061.)

3817. Standard Telephones & Cables, Ltd.—Attenuators for high-frequency electric transmission lines. 16th February, 1951. (693193.)

4625. Cambridge Instrument Co., Inc.—Electrocardiograph. 26th February, 1951. (693132.)

4642. Standard Telephones & Cables, Ltd.—Electric capacitors. 22nd February, 1952. (693062.)

4659. Etablissements Merlin & Gerin.—High-voltage transmission lines with suspended circuit breakers. 26th February, 1951. (693133.)

4749. General Electric Co., Ltd., Arbon, R. S., Elson, D. W., and Hunt, G. J.—Electric pulse signalling systems. 27th February, 1952. (693134.)

5791. Reumerman, T., and Helmig, W. H. T.—Devices for facilitating the detection of errors in symbol groups. 9th March, 1951. (693250.)

6523. Automatic Electric Laboratories, Inc.—Party-line identification dial. 19th March, 1951. (693137.)

6916. Radio Heaters, Ltd.—Radio-frequency transformers. 21st March, 1952. (693066.)

7542. Goldberg, M.—Electrical testing devices. 1st April, 1952. (693253.)

7728. Akt.-Ges. für Stickstoffdünger.—Electrode holding devices for electrothermic melting furnaces. 3rd April, 1951. (693068.)

8445. Radio Corporation of America.—Radio navigation apparatus. 11th April, 1951. (693145.)

8508. Automatic Telephone & Electric Co., Ltd.—Carrier current transmission systems. 9th April, 1952. (693255.)

8536. Jacquier, P. A. C.—Storage batteries. 12th April, 1951. (693070.)

8786. Electric Storage Battery Co.—Electric batteries. 16th April, 1951. (693071.)

9215. Drysdale & Co., Ltd.—Pump and motor assembly. 22nd February, 1952. (693258.)

10046. Technical Assets, Inc.—Method of making artificial piezoelectric elements. 30th April, 1951. (693322.)

11924. Sulzer Freres Soc. Anon.—Control of salinity in steam generating plants. 22nd May, 1951. (693326.)

12021. Carlsson, D. I., and Klingberg, O. H.—Electrically heated soldering appliance. 23rd May, 1951. (693197.)

13087. Metropolitan-Vickers Electrical Co., Ltd.—Curve tracing devices. 3rd April, 1952. (693327.)

13364. Marconi's Wireless Telegraph Co., Ltd.—Radio beam scanners. 3rd April, 1952. (693263.)

13919. Sulzer Freres Soc. Anon.—Steam generating plants and methods of operating them. 12th June, 1951. (693330.)

17248. Infilco, Inc.—Apparatus for telemetering signals. 20th July, 1951. (693334.)

19776. Brush Development Co., and Lynch, T. E.—Electromechanical transducer unit. 17th February, 1948. Divided out of 693161. (693204.)

20230. Power-Gas Corporation, Ltd., Holmes, F. R., and Stoddart, A. L.—Control systems for electric motors operating double skip hoists. 28th August, 1951. (693205.)

20631. Sangamo Weston, Ltd.—Polyphase watt-hour meters. 31st August, 1951. (693338.)

20693. General Motors Corporation.—Compressors for refrigerator systems. 3rd September, 1951. (693082.)

21162. Bendix Aviation Corporation.—Voltage limiting device. 7th September, 1951. (693085.)

23076. Airtron, Inc.—Quick disconnect coupling for electric power cables. 3rd October, 1951. (693089.)

23137. British Thomson-Houston Co., Ltd.—Remote control units for electrical apparatus. 4th October 1951. (693339.)

25344. British Thomson-Houston Co., Ltd.—Centrifugally operated clutches for washing machines. 30th October, 1951. (693091.)

27876. Mallory Metallurgical Products, Ltd.—Electrical switch contacts and contact structures. 28th November, 1951. (693342.)

27931. British Thomson-Houston Co., Ltd.—Stopper construction for strainers, for sinks and the like. 28th November, 1951. (693343.)

28033. Hoover, Ltd.—Centrifugal switches for electric motors. 29th November, 1951. (693208.)

28979. Western Electric Co., Inc.—Magnetic storage devices. 11th December, 1951. (693157.)

29076. Bosch Ges., R.—Electric condensers. 12th December, 1951. (693093.)

1952

2728. International Research & Development Corporation.—Magnetic recorder head assembly. 1st February, 1952. (693346.) 2729. Electro-magnetic head. 1st February, 1952. (693347.)

3707. Sylvania Electric Products, Inc.—Lighting fixture of louvre construction. 12th February, 1952. (693097.)

6479. Motor Products Corporation.—Refrigerator breaker strip and control assembly. 12th March, 1952. (693350.)

NEXT WEEK'S EVENTS

Monday, 18th May

ILFORD.—The Red House, Redbridge Lane, 7 p.m. Purchasing Officers' Association, East London Branch. Film: "Electronic Navigation Instruments."

LIVERPOOL.—Radiant House, Bold Street, 7.15 p.m. Incorporated Plant Engineers, Liverpool Branch. Plant Maintenance Team's visit to U.S.A.; report by C. Troup.

LONDON.—Savoy Place, 7 p.m. I.E.E. London Students' Section. Annual general meeting, followed by a film show.

Tuesday, 19th May

GLASGOW.—39, Elmbank Crescent. Purchasing Officers' Association. Glasgow Branch. Annual general meeting.

HULL.—Royal Station Hotel, 7.15 p.m. Purchasing Officers' Association, Hull Branch. Annual general meeting, and short topical film.

LIVERPOOL.—Mitre Hotel, Dale Street, 7.30 p.m. Purchasing Officers' Association, Liverpool Branch. Annual general meeting.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurements Section. Lecture on "Measurement with the Flying-Spot Microscope," by Prof. J. Z. Young.

Savoy Place, 6 p.m. I.E.E. Education Discussion Circle. Questions night.

Savoy Hotel, 7.30 for 8 p.m. Gauge & Tool Makers' Association. Coronation ball.

ST. ALBANS.—Peahen Hotel, 7.30 p.m. Incorporated Plant Engineers, Herts Discussion Group. "Sound Control in Industry," by W. A. Hines and D. G. Smart.

Wednesday, 20th May

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Supply Section. Lecture on "The Utilization of Solar Energy," by Dr. E. C. Bullard.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. "Principles of Organization," by D. V. Burling.

ST. AUSTELL.—Faraday Hall, 3 p.m. I.E.E. South-Western Sub-Centre. "The Design and Performance of Surge Diverters for the Protection of Alternating-Current Systems," by T. F. Monahan.

STAFFORD.—At the English Electric Co.'s lecture theatre, 7 p.m. I.E.E. North Staffs Sub-Centre, Students' Section. Annual general meeting.

WIMBLEDON.—32, Worple Road, 8.15 p.m. A.S.E.E. South West London Branch. "Electrical Contracting," by G. Kitchener.

Thursday, 21st May

DUBLIN.—28, Merrion Square, 3 p.m. I.E.E. Irish Branch. Annual general meeting.

SHEFFIELD.—Grand Hotel, 7 p.m. Purchasing Officers' Association, Sheffield Branch. Annual general meeting.

Plant Engineers' Conference

The sixth annual conference of the Incorporated Plant Engineers will be held from 20th to 22nd May at Southport. Except for the civic reception, which will be held at the Floral Hall, all functions will take place at the Palace Hotel. In addition to the technical sessions a number of social functions have been arranged.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Altrincham.—26th May. Town Council. Market lighting scheme. (See this issue.)

Australia. — SYDNEY. — 2nd July. County Council. "Translay" type protective relays for substations. (C.R.E. 16111/53. Ten/6338.)*

MELBOURNE.—27th May. Victorian Railways (Electrical Engineering Branch). Stainless steel sheathed telephone cable and accessories. (C.R.E. 16207/53. Ten/6371.)*

Belfast.—25th May.—Northern Ireland Housing Trust. Electrical installations in 46 houses in Dungannon. Forms of tender, etc. from the Trust's offices, 12 Hope Street, Belfast.

Bredbury and Romiley.—6th June. U.D.C. 118 precast concrete street lighting columns and bracket arms, with lanterns, lamps and control gear; also lanterns, control gear, etc. for lighting Trunk Road A.560. Surveyor, Council Offices, George Lane, Bredbury.

Canada.—VANCOUVER.—28th May. Greater Vancouver Water District. Three-phase distribution transformer, turbines, pumps and generator. (C.R.E. 16087/53. Ten/6369.)*

East Riding.—26th May. County Council. Installation of electrical services at the Institute of Agriculture, Bishop Burton. County architect, County Hall, Beverley.

Egypt.—CAIRO.—16th June. Ministry of Public Works. Supply and erection of a transformer station at Helwan. (C.R.E. 12258/53. Ten/6307.)*

Formosa.—TAIPEI.—3rd June. Central Trust of China. Two 75 kW diesel-driven generators with two 115 b h.p. diesel engines, and two 20 kW generators with two 35 b.h.p. diesel engines. (C.R.E. 15532/52. Ten/6313.)* 5th June. Electrical marine equipment. (C.R.E. 15574/53. Ten/6306.)* 8th June. Supply of 500 V armoured lead cable. (C.R.E. 15576/53. Ten/6321.)*

India.—NEW DELHI.—27th May. Director-General of Supplies and Disposals. Train lighting dynamos (C.R.E. 15118/53. Ten/6267.)* 2nd June. Train lighting dynamos. (C.R.E. 15119/53. Ten/6270.)* 31st July. Train lighting lead acid cells. (C.R.E. 15120/53. Ten/6287.)* 16th June. Four 15 kW and two 10 kW motor generator sets. (C.R.E. 15874/53. Ten/6324.)* 2nd June. Automatic morse code transmitter, etc. (C.R.E. 16456/53. Ten/6342.)* 12th June. 60 kW air cooled single bulb mercury arc rectifier. (C.R.E. 16419/53. Ten/6344.)*

TRIVANDRUM.—25th May. Government of Travancore-Cochin. Electric meters and measuring instruments. (C.R.E. 16620/53. Ten/6363.)*

Iraq.—BAGHDAD.—21st May. Directorate of Municipalities. Three 50 kW diesel-electric generating sets. (C.R.E. 15706/53. Ten/6319.)*

London.—19th June. India Store Department. Supply of 660 V cable. (See this issue.) 26th June. One high voltage testing transformer. (See this issue.)

Morley. — 8th June. Corporation. Street lighting equipment. (See this issue.)

New Zealand.—WELLINGTON.—22nd June. Director-General (Stores Division), G.P.O. V.h.f. multi-channel radio-telephone equipment. (C.R.E. 15832/53. Ten/6323.)*

Pakistan.—KARACHI.—30th May. Posts and Telegraphs Department. Carrier telephone systems. (C.R.E. 13957/53. Ten/6343.)*

Rowley Regis.—27th May. Corporation. Street lighting equipment. (See this issue.)

South Africa.—JOHANNESBURG.—10th June. South African Railways. Radio telephone equipment. (C.R.E. 15596/53. Ten/6291.)* 21st May. Ventilating fans and tubing. (C.R.E. 15618/53. Ten/6308.)*

CAPE TOWN.—17th June. City Electricity Department. 12 kV single-core cable. (C.R.E. 16552/53. Ten/6355.)*

United States. — DETROIT. — 19th May. Department of Purchases and Supplies. One 40,000/50,000 kW reheat hydrogen-cooled turbo-generator. (C.R.E. 15334/53. Ten/6305.)*

Uruguay. — MONTEVIDEO. — 10th June. Direccion General de Communicaciones-Servicio de Transmisiones. Telegraph equipment and accessories. (C.R.E. 15514/53. Ten/6292.)*

ORDERS PLACED

Barrow-in-Furness. — Markets and Parks Committee. Electrical installation at the Market (£1,985).—Hadwin & Son.

Carlisle.—Education Committee. Electrical services at the new Harraby Junior School (£2,875).—David Thomson & Sons, Ltd.

London. — POPLAR. — Borough Council. Recommended. Electrical installations in flats (Blocks L & B), Bazely Street (£1,171).—London Electricity Board.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdare.—Pithead baths and medical centre, Rhigos; National Coal Board, Cambrian Buildings, Cardiff.

Aylesbury.—Houses (36) for R.D.C.; R. C. White, Council's architect, 4, Temple Square, Aylesbury, Bucks.

Berwick.—Fish canning factory for J. Van Smirren, Ltd.; R. Small, builder, Tweedmouth, Berwick.

Bexley.—Reconstruction of pumping station (£71,000); Metropolitan Water Board, New River Head, Rosebery Avenue, E.C.1.

Caernarvon.—Blocks of flats on three sites; W. Rees Davies, borough surveyor, Guild Hall.

Denton.—Flats (20), Haughton Hall site; engineer and surveyor.

Devonshire.—County primary schools at Newton Abbot and Plympton St. Maurice, and special school at Torquay; county architect, Heavitree Road, Exeter.

Doncaster. — Four new schools proposed (£365,512); borough architect.

Ealing.—Dwellings (104), Fairview estate; borough engineer.

Egham.—Houses (66); U.D.C. surveyor, Fire Station Buildings, High Street.

Ely.—Houses (48), Sutton and Little Thetford; surveyor, Rural Council Offices, Lynn Road.

Gateshead. — Pickle factory; Arthur & Kerkup, Swinburne Street.

Greenford. — Office block, Ruislip Road; Taylor Woodrow, Ltd., Adrienne Avenue, Southall.

Guildford.—Works extensions; Dennis Bros., Ltd., Woodbridge Road.

Hull.—Rebuilding departmental store, Spencer Street; Bladons, Ltd., Prospect Street.

Jarrow-on-Tyne.—Fifty "Unity" houses in South Leam Lane; borough engineer.

Kettering. — Grammar school, Windmill Avenue (£109,000); county architect, Northampton.

Lancaster. — Maternity unit adjacent to Royal Infirmary; T. Duffy, architect to Manchester Regional Hospital Board, Cheetwood Road, Manchester.

Letchworth.—Houses (54), Grange estate; U.D.C. surveyor, Council House, Broadway.

London. — HIGHGATE. — Extensions to Channing School (£30,000); R. J. Adams, Ltd., builders, 11, Finsbury Square, E.C.2.

PADDINGTON.—Flats (408), Hallfield estate; F. G. Minter, Ltd., builders, 4, Buckingham Gate, S.W.1.

Maidstone. — Additional factory building; Albert E. Reed & Co., Ltd., Bridge Mills, Tovil.

Manchester.—New buildings at Irwell Wharf for Ship Canal Co.; Cruikshank & Seward, architects, 16, Princess Street, Manchester.

Newcastle-on-Tyne. — Archæology and anthropology department, Sydenham Terrace, for King's College; Turley & Williamson, 14, Eldon Place.

School of art and industrial design, Clayton Road; branch libraries at Kenton, Benton Hall, Jesmond and Denton; and houses at Kenton (1,937) and Fawdon (604); city architect, 18, Cloth Market, Newcastle.

Newchurch.—New classroom block at Hospital for Liverpool Regional Hospital Board; Kearsley & Gee, Ltd., Heath Road Sawmills, Ashton-in-Makerfield.

Norfolk. — Primary school, Marham, and secondary modern school, Downham Market; G. W. Oak, architect, Stracey Road, Norwich.

Northumberland.—Child welfare centres at Bedlington Station, Tweedmouth, Haltwhistle, Hexham, Red Row, Whitley Bay and Willington Quay; county architect, County Hall, Newcastle-on-Tyne.

Oakham.—Four-class junior school, Burley Road, and three-class infants' school on site occupied by old school; county architect, Oakham.

Penrith.—Houses (38), Brentfield Way, Scaws estate, and Brent Road; U.D.C. surveyor.

Richmond (Surrey).—Ham county secondary school (£134,220); J. Harrison, county architect, County Hall, Kingston-on-Thames.

St. Albans.—Shops with flats over on sites at St. Julians and New Greens, and 50 houses and flats on the Marshalswick Lane estate; city surveyor, 16, St. Peter's Street.

Sheffield.—Offices, laboratories and machine shops at Solly Street for Yorkshire Testing Works, Ltd.; G. Longden & Sons, Ltd., St. Peter's Close, Sheffield.

Solihull.—Tudor Grange Grammar School for Boys (£184,245), as first part of education centre to include girls' grammar school, technical college, and two secondary technical schools; C. R. Hutchinson, town surveyor, 90, Station Road.

Swadlincote. — Houses (54), Hartshorne estate, for U.D.C.; F. Perks, Ltd., Long Eaton.

Thorne.—Houses (78), South Common estate; P. Lambert, clerk to R.D.C., Council Offices, Thorne, Doncaster.

Wallsend.—Houses (160), Churchill Street; J. W. Hanson & Son, architects, 123, Northumberland Street, Newcastle-on-Tyne.

Walsall.—Development of estate at Mossley, providing for houses, shops, church, schools and other public buildings; M. E. Habershon, borough surveyor, Council House.

Watford. — Dwellings (90), Cecil Lodge, Abbots Langley; Dawe, Carter & Partners, architects to R.D.C., 33, Clarendon Road, Watford.

Wellington (Salop).—Houses (229) on three sites at Hadley, for R.D.C.; J. Brian Cooper, architect, 177, Corporation Street, Birmingham, 4.

West Bromwich. — Secondary school at Churchfields; borough surveyor, Town Hall.

Worcester.—Shops and maisonnettes on the Newtown No. 2 estate; city surveyor, 22, Bridge Street.